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KING GEORGE VI

We record humbly and with profound regret the death of King George VI which took place peacefully in his sleep on February 6. The King, who was 56, was in the sixteenth year of his reign. The news of his death came as a great shock to the nation. Every one of our readers will have felt a deep and personal sense of loss in the passing of a Sovereign who embodied in his devotion to duty qualities which we instinctively seek but so often fail—as he did not fail—to achieve. The sympathy of all engaged in the gas industry extends to those near and dear to our late beloved Monarch. The inspiration of King George VI remains and will ensure undying devotion to our Queen and Sovereign Elizabeth II. On February 6, the following message was sent by the Gas Council to Her Majesty:—Members of the Gas Council assembled in meeting today present their humble duty to Her Majesty the Queen and beg to express their profound sorrow at the death of His Majesty King George VI and to convey to Her Majesty and to all Members of the Royal Family the deepest sympathy in their bereavement. A message from the Institution read:—The Council and Members of the Institution of Gas Engineers humbly desire to express their profound sorrow and sympathy upon the death of His Majesty King George and dutifully offer to your Majesty their respectful assurances of loyalty and devotion on your accession to the Throne.

THREE-ZONAL TARIFF

THE first impression of the three-zonal tariff structure adopted by the North Eastern Gas Board and endorsed, after much hesitation, by the Consultative Council is that by defining a new set of boundaries which bear no relation to those of the six operational groups into which the area was divided on vesting day it has created new and unnecessary confusion which more than offsets the advantages to be derived from reducing the number of different kinds of tariff. The Board has long since decided that it is unnecessary to have special prices for particular usages of gas; in other words, the requirements of consumers using gas for, say, central heating and bread-baking can be adequately covered in the normal manner and at economic rates without the need to introduce an alternative method of charge. Consumers at Bridlington may well ask why they should pay 1½d. per therm more for their gas than the people of Pudsey; similarly, the inhabitants of Ilkley may wonder why neighbours on one side pay ¾d. per therm less and on the other ¾d. per therm more than they themselves are charged. The new tariffs will replace all existing tariffs as from February 11 except in certain special cases where the Board is obliged to give formal notice of termination of existing tariffs, and all main meter rents will be abolished. The new rates are as set out on p. 410.

A small minority of both domestic and industrial consumers have continued to enjoy very advantageous methods of gas charges and these will undoubtedly feel the effect of the new tariffs on a comparative basis. The Board has rightly felt that with rapidly increasing costs and the trend towards integration some effort should be made to effect a measure of uniformity, and from its earliest days the Consultative Council has held the view that one tariff for the whole area should be the natural outcome of nationalisation. This has many merits and is a hope that may possibly be realised in the years to come, but at the present stage, with most districts still producing and distributing gas within the same limits as previously, the Board deemed the time inopportune to take such an overriding step. In May, 1949, the Board found that some undertakings had raised prices to adjust their financial position; others had schemes in hand for rectifying deficiencies in plant capacity; and still others, anticipating nationalisation, were doing little or nothing in the way of plans for plant extensions. Gas charges were therefore not necessarily a true reflection of the financial circumstances of the various undertakings.

During the time the Board has been in existence it has been possible to make a first survey of the needs of the whole area. Plant extensions, integration schemes, and centralisation of certain aspects of administration have removed all possibility of comparing old undertaking districts with those of the future. Local government status, population, numbers of consumers, annual gas sales, and other matters were considered as possible bases for fixing the new tariffs and the Board ultimately concluded that delivered cost of coal was the fairest basis, and it is on this that the tariff has been developed. It is of interest to note that prompt payers will receive a discount of 5%; prepayment consumers will pay 1d. per therm supplementary charge on the first 100 therms per annum; and to ensure some return on the Board's services and equipment a minimum payment each quarter will be imposed on consumers based on their installed meter capacity, ranging from 6s. 6d. per quarter in respect of meter capacity up to 200 cu.ft. per hour to £26 5s. per quarter in respect of meter capacity up to 3,000 cu.ft. per hour. The Board has included in its official notice an intimation that it has fixed the maximum price at which gas may be resold (by hotels, owners of flats, etc.) at 3d. per therm above the price charged to consumers in the zone taking supplies direct from the Board through a main meter.

RIGHT OF ENTRY

CONSULTATIVE Councils are still discussing the issues arising out of the forcible entry case in which the Eastern Gas Board was involved last year, notwithstanding that the case has been settled so far as the Court of Appeal is concerned and a final appeal to the House of Lords is being considered. Paragraphs 34 to 36 of the Third Schedule of the Gas Act, derived with adaptations and amendments from the Gasworks Clauses Act, 1871, and the Gas Undertakings Act, 1934, define the powers of area boards to break into premises for specified reasons and the obligations on them to leave premises secure and make good any damage. Because last year's proceedings raised questions concerning the sanctity of the home, however, members of consultative councils (properly regarding themselves as guardians of the consumers) have sought to hedge the legislation round with all sorts of limitations, although it is abundantly clear that area boards have always been reluctant—and will be even more reluctant in the future in the light of the Edmonton case—to have recourse to extreme measures.

It would seem from the discussions at some of the consultative council meetings that members are afraid that the boards will violate the privacy of the home on almost any pretext, whether the consumer is away on holiday, sick in hospital, or merely out doing the shopping. All sorts of precautions have been suggested, from insistence on the presence of a policeman when the actual breaking in is to be performed to the sending of reply-paid registered letters to offending consumers. At the South Eastern Consultative Council meeting last week a lady member proposed that so far as the collection of money from meter coin boxes was concerned the Board's remedies should be restricted to civil law proceedings and that forcible entry should be resorted to only in the event of emergencies as defined in the Third Schedule. Councillor Constable, appropriately named Chairman, told the Council that when a board recently applied to a magistrate for power to break in the application was refused on the ground that the board already had all the legal rights it required. The money in the coin box is, as Mr. Constable pointed out, the property of the board, but only in the last resort does any board exercise its powers of forcible entry. The only people who are likely to trouble the boards in future are

tricksters and the stupidly obstinate. One member of the South Eastern Council last week told a story of a 'high ranking naval officer'—it is usually the high rankers who are singled out for criticism—whose gas bills over a period of years were so low as to arouse suspicion. An inspection—effected in that case, we presume, without forcible entry—revealed that the meter connections had been tampered with and gas had been obtained dishonestly. Responsible officials, if not the gas boards themselves, have been in the industry long enough to be able to judge fairly well when to break in, and when not to break in, and we shall be surprised if the memorable case of 1951 proves to be anything other than a historic exception.

FRIENDLY CO-OPERATION

FOR 12 months the National Association of Local Government Officers and the British Gas Staff Association have very harmoniously operated an agreement designed to create and maintain friendly relations between the two organisations. There was, however, a clause in the agreement which prohibited the one organisation from accepting members in any undertaking where it had no members and where the other organisation had the majority of the staff organised. Difficulties were experienced owing to the loss of the separate identity of undertakings as they were merged into divisions or districts and the staff members were changed from place to place. Moreover, the last conference of the B.G.S.A., while supporting the agreement, resisted any limitation on the freedom of the individual regarding his choice of a union. We gather from the February issue of *Thermfare*, journal of the B.G.S.A., that the national councils of the two bodies have now agreed that the clause referred to shall be deleted. The agreement now operating confirms that both organisations will co-operate, that neither will issue derogatory propaganda, and that neither will accept as a member a person who has been a member of the other during the preceding six months without prior agreement. One of the effects of the amendment is that the B.G.S.A. is freed from restrictions at Birmingham, about which delegates heard a great deal at the last conference.

IS THE CONSUMER INTERESTED?

FRIENDLY relations between so-called rivals were exemplified last week when the South Eastern Gas Consultative Council met in the council chamber of its opposite number, the South Eastern Electricity Consultative Council, at Brettenham House and received a report from Mr. V. W. Stanton, Commercial Manager, in the course of which he said that under the restriction of promotional advertising the Gas Board had done nothing to upset the susceptibilities of the Electricity Board. Judging from the small numbers of the public who attend other consultative councils we begin to doubt whether consumers are interested in procedure, but if public attendance is to be encouraged then the idea of both councils having a common meeting place is good, provided a large enough room is available. If the Council meets permanently in London it places the consumer in remote Ramsgate, Brighton, or Petworth at a disadvantage compared with the Londoner; but can the Council be expected to go on circuit just for the convenience of, perhaps, a couple of consumers? Surely the most sensible thing is to meet in London, the focal point for the area.

The fact that the London County Council and the Gas Consultative Council have both chosen to meet on Tuesdays raises a delicate question concerning the two or three people who are members of both. The L.C.C. cannot well be expected to depart from long-established practice; on the other hand a large majority of the consultative councillors last week demonstrated the impracticability of finding a suitable alternative day. It was agreed to make no change, but it does not seem satisfactory to let the matter rest there. The L.C.C. is an important, influential, and publicly-elected body and some further effort should be made to meet the situation. It has been pointed out repeatedly that when nominees take their seats they represent the consumers in general and not their nominating authority in particular, but that does not help to solve the problem, for the Act clearly refers to the nomination of 'members of local authorities' and the L.C.C. could not therefore nominate outsiders to be appointed to the Consultative Council.

BUTANE/AIR PLANT

WE are informed that the butane/air mixing plant now working at Whitland, Carmarthenshire, as described in the *Journal* of February 6 (p. 347) was supplied by the firm of Mallet, S.A., 10, Rue de Milan, Paris (9e), through W. C. Holmes & Co., Ltd., of Huddersfield and London. We also learn that W. C. Holmes & Co., Ltd., have secured the exclusive licence for these plants and that further installations are in manufacture for the Wales Gas Board and other area boards.

Letters to the Editor

TRAY PURIFIERS

DEAR SIR,—The paper entitled 'Recent Developments in Oxide Purification Plants' given to the Institution of Gas Engineers (London and Southern Section) by Mr. G. U. Hopton, is an excellent summary of the position today from an economic and technical point of view.

Two main issues are made evident in the paper and confirmed by the subsequent discussion—firstly, the need for a generally accepted design approach, and secondly the effect of personal opinion (c.f. the discussion, *Gas Journal*, January 30) and its influence on mechanisation, number of boxes, split flow, area versus depth, corrosion and materials, etc.

Dr. J. Burns remarked that we knew little about the oxide reaction. It is suggested that since the moisture content of the oxide charge is important it could be inferred that there is solution of hydrogen sulphide in the moisture film and subsequent chemical reaction with the active material in the oxide. The fact that the solubility of hydrogen sulphide in water decreases with temperature rise may indicate that direct reaction with the solid is the controlling element since increase in temperature speeds up the reaction.

In the first instance then, linear velocity would appear to be important and in the second time contact or the value of the 'R' ratio.

The application of Steere's formula to a number of existing installations of orthodox boxes working up to capacity has proved its merits and shows 'R' ratios of 35 and 40 to be reasonable values. 'R' ratios below these would appear to be conservative, and only justified on orthodox box installations where oxide removal is arduous.

Tray purifiers, by virtue of the ease with which a box may be emptied and recharged, are designed with these higher 'R' ratios, the consequential saving on capital charges and operating costs justifying the installation of tray handling equipment. Due to the heavier loadings there is also a decrease in capital cost per therm. The multiple inlets to a tray purifier box ensure excellent distribution without chilling, although split flow appears to meet with some criticism. Split flow with reversal largely overcomes the objections to this method.

Analyses of oxide from the York tray purifiers show very even distribution of sulphur through the oxide, reversal of

flow having been practised. Pressure drop across boxes will influence power costs and at times may force a box to be taken off when otherwise unnecessary. The advantage of the low back pressure in tray purifiers will therefore be evident. The question of wasted ground area to the extent of about 14% must be considered in conjunction with many other aspects particularly the 'R' ratio.

The use of pneumatic tools to break down caked oxide must detract from any attempt at mechanisation, and we are investigating means for the removal of material from trays with the elimination of manual labour. It is realised, however, that the problem is a major one and will require considerable ingenuity to overcome.

To meet the requirements of those engineers interested, we are developing a method for mechanical filling of trays, but it is pointed out that the use of a mechanical shovel affords an excellent solution with trays at ground level with the financial advantage that the shovel may afterwards be used elsewhere, a point brought out in the discussion.

It may be of interest to state that we have obtained the order for the manufacture of a set of five tray type purifiers. The connections will be so arranged that normally four boxes will be on stream, the fifth standing charged with fresh oxide containers. Any one box may be taken off and the new box brought into line. The arrangement may be viewed as a set of four working boxes with the usual rotation and a stocking box, the latter ready at any time to take its place anywhere in the stream. Since the stocking box may be any one of the five, all boxes are provided with inert gas connections. The designed capacity is 8 mill. cu.ft. per day of coal gas, inlet hydrogen sulphide burden 800 grains per 100 cu.ft. and with an 'R' ratio of about 40.

Yours faithfully,

RALPH POLLARD,
Research and Development Engineer.

R. & J. Dempster, Ltd.,
Manchester.

February 4, 1952.

STEEL AND CAST IRON

DEAR SIR,—Why, in the second half of the twentieth century, is the British gas industry waiting for cast iron pipes for gas mains? The oil industry throughout the world and the gas industry in North America seem to have long enduring success with steel mains of about half the weight of cast iron ones. Can it be because cast iron is less difficult to obtain than steel?

Such cast iron pipes may weigh twice as much as steel ones—and so need twice the scarce raw materials and twice the scarce coal (or coke) to make the iron or steel, and twice the transport for those materials and that coal (or coke).

That your editorial (*Journal* of February 6, p. 341) should suggest intervention by the Minister of Supply to reconcile differences between iron founders and the steel industry implies a need for co-ordination. The fact that the making of iron and steel involves both coal and transport on a colossal scale would seem to imply a need for policy decisions at the highest political level to give clear indications and a strong lead to all the many industries concerned, to enable them to play their parts worthily in Britain's recovery. Meanwhile, the need to save every possible pound of metal—whether in mains or plant or appliances—is of vital importance to our national economy and so is worth effort to overcome difficulties and excuses.

Yours faithfully,

T. B. V. HIRST.

9a, Cheviot Court, Luxborough Street,
London, W.1.

February 7, 1952.

Personal

Mr. W. Regan, J.P., Chairman of the North Eastern Gas Consultative Council, has accepted an invitation to be the next Mayor of Halifax.

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Mr. J. C. Mason has ceased to act as Midlands and Eastern Counties representative for C. R. Averill, Ltd. Pending further appointment **Mr. A. W. Goode,** Sales Manager, will take care of the area.

Mr. K. Fernie, Technical Assistant at Wisbech to Eastern Gas Board for the past two years, has left to take up a similar position at Bedford and has received a presentation from his colleagues at Wisbech.

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Mr. George Mark-Bell, who started his gas industry service with Carlisle Corporation Gas Department, has been appointed Distribution Superintendent in the Falkirk district, South East division, Scottish Gas Board.

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Mr. Leslie O'Connor, C.B.E., has been appointed Director-General of Carbonisation, National Coal Board, and will be responsible to the Board for the production of carbonised and other processed fuels. Hitherto Mr. O Connor has been Director of Carbonisation and Deputy Director-General of Marketing (Carbonisation) at the Board's headquarters. **Sir William McGilvray,** C.B.E., Director-General of Marketing, will continue to be responsible for the marketing of coke and other products of carbonisation.

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Mr. Albert Pickard, M.INST.GAS E., Engineer, Manager, and Secretary of the Llanelly and Gowerton undertakings of the Wales Gas Board, is the first member of the gas industry to attend the Administrative Staff College at Henley-on-Thames, where he has recently started a three months' course. Mr. Pickard, who is convener of the Swansea Group Committee responsible for the administration of the six undertakings at Swansea, Llanelly, Gowerton, Ammanford, Pontardulais, and Pontardawe, has taken a great interest in the educational side of the industry and since 1946 has been Secretary of the Wales and Monmouthshire District Education Committee. From 1949 to date he has been Secretary of the Wales Gas Board Education Committee and Wales representative on the Gas Council Education Committee. He is at present Chairman of the Wales and Monmouthshire Section of the Institution of Gas Engineers. The Gas Council is making arrangements on behalf of the industry for representation at future courses of the Administrative Staff College.

Obituary

Mr. W. G. Lucas, who had been associated with the gas industry for a number of years and had been District Manager for the East Midlands Gas Board, died suddenly at Long Buckby at the age of 64 on February 5. He set off to attend a meeting during the evening but called at a friend's house as apparently he did not feel well. Within a few minutes of entering the house he had collapsed and died.

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Mr. Frank Higginson, who retired from the post of Engineer, Manager and Secretary of the Petersfield and Selsey Gas Company during the last war, has died at Blackpool, where he was living in retirement, aged 80. A native of Holmfirth, Mr. Higginson entered the gas industry at the Holmfirth works, where his father was Manager. He later went to the Elland works. In 1900 he became Engineer, Manager, and Secretary of the Broadstairs Gas Company and some years later took up a similar post at Petersfield and Selsey.

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Mr. T. A. M. Roberts, Sales Director of the Metals Division of Imperial Chemical Industries, Ltd., died suddenly on February 3, aged 51. His service with I.C.I. Metals Division dated from 1916. He became Metals Sales Manager in 1937 and was appointed to the Division Board in 1945. As the Company's representative in almost all the trade associations of the wrought non-ferrous metals industry, he was widely known and respected in the trade. At the time of his death he was Chairman of the Brass and Copper Tube Association and the Extruded Brass and Copper Alloys Association, and had held executive and advisory offices in the Cold Rolled Brass and Copper Association, the High Conductivity Copper Association and the Brass Wire Association. He was a prominent member of the executive committee of the British Non-Ferrous Metals Federation.

Diary

Feb. 16.—Yorkshire Juniors: 'Gasworks Effluents,' W. H. Blackburn, PH.D., M.SC., Research Chemist to Joint Research Committee of Gas Research Board and Leeds University. At Leeds University.

Feb. 19.—Institute of Fuel: 'An Investigation of Whole House Heating,' F. C. Lant, A.M.I.H.V.E., and J. C. Weston, PH.D., M.I.H.V.E., Institution of Mechanical Engineers, Storey's Gate, S.W.1. 5.30 p.m.

Feb. 19.—London and Southern Section, I.G.E.: 'The Consumer and the Gas Industry in a World of Changing Standards,' Professor D. M. Newitt (Past President, Institution of Chemical Engineers), 17, Grosvenor Crescent, 2.30 p.m.

Feb. 20.—Wales Juniors (North): Shotton. Visit to spent oxide treating plant of J. Summers.

Feb. 21.—Midland Juniors: Half-day visit to Humber, Ltd., Coventry.

Feb. 21.—London and Southern Juniors: Visit to Thomas De La Rue & Co., Ltd., Cavendish Works, Wandsworth, 2.30 p.m.

Feb. 21.—Institute of Sewage Purification (Metropolitan Division): Paper by Philip Wedgwood (Eastern Gas Board), Friends House, Euston Road, London, 6.30 p.m.

Feb. 23.—Manchester Juniors: Annual Dinner. Manchester.

Feb. 28.—Society of Chemical Industry (Yorkshire Section): Joint meeting with Leeds University Chemical Engineering Society: Hodsman Memorial Lecture, A. C. Monkhouse, B.SC., PH.D., F.R.I.C.

Feb. 28.—North Thames G.C.C.: Westminster City Hall, Charing Cross Road, 2.30 p.m.

Feb. 28.—Eastern Section, I.G.E.: Discussion on Report of Institution of Gas Engineers' Sub-Committee on Unaccounted-for Gas, introduced by Lieut.-Col. J. A. Gould, M.C., M.I.MECH.E., M.INST.GAS E. Town Hall, Peterborough, 2.30 p.m.

Mar. 1.—Midland Juniors: Annual Dinner, Imperial Hotel, Birmingham.

Mar. 3-29.—Ideal Home Exhibition, Olympia. Gas Council stand No. 67, Grand Hall.

Mar. 4.—South Eastern G.C.C.: Caxton Hall (Kent Room), Westminster. 2.15 p.m.

Mar. 4.—East Midland G.C.C.: Victoria Station Hotel, Nottingham, 11.30 a.m.

Mar. 4.—Midland Juniors: 'The Equipment of Combustion Safeguard Equipment,' J. Price (Coventry). At Birmingham.

Mar. 7.—London and Southern Juniors: 'Twenty Years of Development in West Kent,' F. T. Buist (South Eastern). 178, Edgware Road, 6.30 p.m.

Mar. 8.—Scottish Juniors: Joint meeting of Eastern and Western Districts; paper by J. T. Haynes, Junior Vice-President, Institution of Gas Engineers. Glasgow, 3 p.m.

Mar. 11-13.—Gas Service Conference. Seymour Hall, W.1. (For full programme see *Journal* of January 16, p. 159.)

Mar. 12.—London and Southern Juniors: Visit to Lewis Berger works, Homerton. 2 p.m.

Mar. 12.—Yorkshire Juniors: President's Day. Visit to Drakes, Ltd., Halifax.

Mar. 12.—South Western G.C.C.: 34, Bridge Street, Taunton, 11 a.m.

Mar. 13.—Manchester and Midland Juniors: Joint visit to James Stott & Co., Ltd., Oldham.

Mar. 14.—Scottish Juniors (Western): Annual Dinner and Dance, Beresford Hotel, Glasgow.

Mar. 15.—Wales and Western Juniors: Joint meeting. 'Gas Masks, Resuscitation, and First Aid,' J. W. Green (Stroud). At Gloucester.

Mar. 17.—Eastern G.C.C.: Connaught Rooms, London, W.C.2, 2 p.m.

Mar. 18.—London and Southern Section, I.G.E.: 'Experiences with Gasholders and Gasometers,' W. H. White (Clerk of Works, North Thames Gas Board), 17, Grosvenor Crescent, 2.30 p.m.

Mar. 19.—South Western Section, I.G.E.: 'Coal,' A. P. Jennings, M.INST.F.(Bath). At Bath.

Mar. 19.—Eastern Juniors: 'Boosters and Governors,' T. W. Aiken and B. I. Stone (Bryan Donkin Co., Ltd.). At Luton.

Mar. 19.—Scottish Juniors (Western): Afternoon visit to Scottish Oil Refineries, Ltd., Grangemouth.

News in Brief

Wellingborough Urban District Council, at its meeting on February 5, turned down a suggestion of the Electricity Board that power points should be installed in new council houses so that tenants might have a choice of cooking facilities. The Council will continue with the installation of gas cookers.

Charges of Theft of Gas by trick were brought against two Silsden women at Skipton. They admitted putting coins other than shillings into prepayment meters at their homes. It was stated that 157 defaced coins had been found at various times in the meter of one of the defendants, who was alleged to have obtained gas to the value of £3 9s. 11d. She also asked for a further offence of obtaining gas value £1 4s. 4d. by the same means since that date to be considered. On January 25 she had repaid £1 and explained that she had been short of money. She was placed on probation for two years, and also ordered to make restitution of £3 9s. 11d. and pay 16s. 5d. costs. In the other case the defendant admitted obtaining gas valued at £1 3s. 8d. between May, 1950, and November, 1951, by using 68 coins other than shillings. A conditional discharge was granted on payment of 16s. 5d. costs. She expressed her regret, and it was stated that the money had all been repaid. The North Eastern Gas Board was criticised by the presiding magistrate Mr. A. C. Bailey, who thought the Board should have drawn attention to these cases earlier.

Scarborough Hotels and Boarding Houses Association has organised for its members a course of lessons on advanced cookery—an attempt to face competition by improving the standard of cooking in Scarborough hotels. The demonstrations are taking place in the North Eastern Gas Board's Scarborough showrooms, and are being given by Mr. J. W. Lovell, Chef-instructor at the Domestic Science Centre of the Scarborough Technical institute. Many of the 60 members of the Association who have enrolled for the course are comparatively expert cooks, and Mr. Lovell has arranged for the syllabus to cover the less usual aspects of the culinary art.

Details of the Summer Meeting of the Illuminating Engineering Society, which is taking place at Eastbourne from May 20 to 23, have now been circulated to all members of the Society. The programme of papers was announced some time ago, but the summaries of the papers given in the notice give a better idea of the scope of the meeting. The attractive and practical programme should result in a large attendance.

Purchasing Officers' Association.—First held at Brighton in 1950, and successfully repeated at Llandudno in 1951, the Purchasing Officers' Association's Minibition will this year again be a feature of the national conference at Harrogate from October 2 to 5. The Association was formed in 1931 and at this conference its coming-of-age will be celebrated. The Minibition, organised by buyers, is designed so that the maximum information regarding exhibitors' products can be displayed attractively and economically. Space considerations will not permit the display to be extended beyond last year's limits, and as already more than half of the 1951 exhibitors have made advance reservations, those interested should lose no time in applying to the Secretary of the Association at Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4, for details.

THE TECHNIQUE OF TEACHING

MOST people can absorb a certain amount of learning by experience, reading, and the daily round, but the ability to instruct in a clear and interesting manner is a technique that has to be directed and developed. The West Midlands Gas Board, aware of this fact, has begun a series of courses on the technique of teaching, organised by the Board's Education Officer, for part-time teachers of gas fitting and gas engineering. The first course was held from January 17 to 20, in Birmingham, when 24 teachers from all parts of the Board's area were welcomed by Mr. G. le B. Diamond, C.B.E., Chairman of the Board.

Some of the subjects dealt with during the course—a residential one—included 'The Importance of Individual Differences in Students,' the 'Interpretation of the Syllabus,' 'Preparing and Presenting the Material,' and 'Visual Aids.'

An interesting lecture on 'Standards and Craftsmanship' was given by Mr. A. V. Horsfall, Deputy Sales and Service Manager to the Board.

Mr. G. le B. Diamond, C.B.E., Chairman of the Board, welcomes members at the opening session of the course.

Gas Service Conference

The preliminary programme of the Gas Service Conference, to be held in London on March 11, 12, and 13 (published in the *Journal* of January 16, p. 159), stated that Mr. H. F. H. Jones, then Chairman of the East Midlands Gas Board, would preside at the Tuesday afternoon session on consumer service, and that a final address on the conference in retrospect would be given on the Thursday by the (then unnamed) Deputy Chairman of the Gas Council.

Arising out of Mr. H. F. H. Jones's appointment as Deputy Chairman, his place at the Tuesday session will be taken by Mr. T. Mervyn Jones, Chairman of the Wales Gas Board; Mr. H. F. H. Jones will, in accordance with the programme, give the retrospect.

The Annual General Meeting of British Benzol and Coal Distillation, Ltd., was held on January 15, at the Abercorn Rooms, Bishopsgate, E.C. Mr. G. H. Johnson, M.I.MECH.E. (the Chairman), in the course of his address, commented on the steps taken during the year to bring the issued capital more into line with the capital employed in the company's business. The report of the directors and the accounts for the year ended October 31, 1951, were unanimously adopted and the final dividend, as recommended, of 7%, less income tax, on £25,000 ordinary stock, following an interim dividend paid in June, 1951, of 4%, less income tax, on £175,000 ordinary stock, was approved.

Scottish Building Centre

LORD BILSLAND told the 14th annual general meeting of the Scottish Building Centre on January 31 that, for the Centre, 1951 had been a year of increasing activity and satisfying progress in many ways. However unsettled the future might be, the primary aim of the Centre would be to continue serving the building industry with efficiency and accuracy, always bearing in mind the difficulties and restrictions encountered by those engaged in the industry.

The number of visitors had reached the total of approximately 20,000, while the number of technical enquiries handled was 9,000. Information sheets issued totalled 22,000. In addition to members of professions and trades, included in the numbers quoted were many members of the general public, and Lord Bilsland felt it most gratifying that the Centre had been successful in such a short time in fostering the interest of the public to such an extent. Many of the professional and technical groups in the West of Scotland had continued, throughout the year, to take full advantage of the facilities provided by the Centre, and the number of meetings, lectures, demonstrations, and special exhibitions held in the Centre's premises had increased tremendously since the formation of the new lecture and exhibition hall.

LONG EATON TRAINEES VISIT BIRMINGHAM

A new training centre has been started at Long Eaton by the East Midlands Gas Board. Members of the first course of trainee district representatives recently visited the Birmingham production centre and technical service department of Radiation Ltd. They were accompanied by Mr. A. T. Raby, Education and Welfare Officer of the East Midlands Board, and Mr. P. J. Bunker, Chief Instructor at the new training centre. Second from right in the mechanised foundry is Mr. Bunker and others in the group are Mr. C. S. Rolls (Radiation Ltd.) and Mr. Raby.

IN PARLIAMENT

Fuel Pot-Pourri

FUEL matters occupied a good deal of question time on February 4—ranging over a wide field from the number of hours put in by part-time members of electricity boards (which appears to be unknown) to the amount of money spent by the Gas Council in redecorating Gas Industry House (which is known and is covered by a Building Licence).

Mr. PHILIP NOEL-BAKER (Derby, South) lost no time in returning to the theme he was pursuing so relentlessly at the close of last session. The ex-Minister must be regretting that he did not take the opportunity of getting the information while he was in office. What he wants the present Minister to tell him is the emoluments of directors in private companies—presumably for purposes of comparison with those of members of nationalised boards. In any case such information is largely available from published reports and accounts to which everybody (including Mr. Noel-Baker) has access. At any rate, the present Minister (with or without this comparative information) is not going to reduce either the number of part-time members or their salaries. Mr. GEOFFREY LLOYD observed somewhat pointedly, moreover, that it would not be wise to under-estimate the weight of responsibility which part-time members bear in general.

Coal Stocks

Sir IAN FRASER (Morecambe and Lonsdale) was worried about the prospects of coal and coke supplies for the remainder of the winter and pressed the Minister for a statement. The latter was immediately forthcoming and must rank among the briefest on record. 'The industrial position,' said Mr. LLOYD, 'is satisfactory. House coal supplies are coming forward well, but stocks are still too low for the time of year.'

The Minister was not allowed to get away with this, however, and a barrage of supplementaries followed—adducing the further information that the total distributed stocks on January 19 were 14,986,000 tons, of which 1,092,600 tons was house coal. The total distributed stocks are almost 4½ mill. tons better than at this time a year ago.

Mr. NOEL-BAKER suggested that this was due to the splendid level of production, which the Minister readily admitted, but added that it was also due to the warmest November and December on record.

Mr. GERALD NABARRO (Kidderminster) sought to give 'superior administration' its share of acknowledgment as a factor in the improvement, to which the Minister rejoined: 'Let us be frank and say that it includes the superior administration of the weather.'

Mr. SYDNEY SILVERMAN (Nelson and Colne) brought the subject to a close on a philosophical note by asking if it was the Minister's view that while the Government are not entitled to the credit for any saving in stock due to abnormally warm weather, they nevertheless remain responsible for any deterioration in stocks due to abnormally cold weather.

Use of Methane Gas

Mr. NABARRO brought up the question of the commercial potentialities of methane gas from coal mines.

Mr. LLOYD observed that the N.C.B. was fully aware of the commercial value of methane but doubted whether British coalfields are likely to carry production so far as some Continental coalfields. At present, he said, methods of collecting methane are mainly experimental, although at one colliery he understood gas piped from the coal seams was providing all the power requirements.

Coal Prices

Mr. J. GRIMOND (Orkney and Shetland) asked the Minister whether he would give further consideration to the sale of coal at uniform price throughout Britain (a question in which the gas industry is not uninterested). On receiving an unequivocal 'No, Sir,' Mr. Grimond suggested that a uniform price was one of the advantages we might expect from nationalisation. It would make for a considerable saving in accountancy and would encourage better distribution of industry.

Mr. LESLIE HALE (Oldham, West) asked the Minister what general directions he has given to the N.C.B., the B.E.A., and the Gas Council, respectively, under the appropriate nationalisation Acts since he has been in office. On receiving the answer, 'None, Sir,' Mr. Hale suggested that the Minister should give very wide publicity to this great tribute to the efficiency with which these industries are being run and to the extreme efficiency of his predecessor who had done everything necessary, as is evidenced by the fact that no directions have been required.

Mr. LLOYD said that if he accepted the Hon. Gentleman's tribute he would also have to pass it on to all the predecessors in his office since nationalisation, because none of them had issued any general directions.

Gas Council Building Licences

Major E. G. R. LLOYD (Renfrew, East) enquired what was the aggregate sum of money represented by past and current Licences issued by his Department for building, reconstructing, repairing, or redecorating of offices and showrooms for the Gas Council.

The MINISTER OF FUEL AND POWER (in a written reply) stated that since nationalisation work at the headquarters of the Gas Council, estimated to cost about £10,000, had been approved by his Ministry after consultation with the Ministry of Works. (We wonder whether the questioner was referring to the gas industry as a whole and not, as the answer implied, to Gas Industry House alone.)

Tar Agreement

Addressing the 29th annual meeting of the Midland Tar Distillers, Ltd., on February 6, Mr. Stanley J. L. Robinson, Chairman, referred to a new long-term contract for the sale and purchase of crude tar, coupled with an agreement whereby the West Midlands Gas Board, and he hoped other boards, would take a financial interest in the Company. To that end the West Midlands Board had purchased 100,000 Ordinary shares. The Directors hoped to complete negotiations with other boards in the near future, and until that was achieved they could not put forward any definite financial plans.

The accounts of the West Midlands Gas Board for the year ended last March showed that the Board already has shareholdings in the Company of a book value of £158,750, on which a gross income of £8,000 was received during the year. Other area boards have similar financial interests in other tar distilling concerns.

FOOD, HEALTH, AND HYGIENE

THE Women's Gas Federation has prepared a heavy programme for its conference on Food, Health, and Hygiene at Stratford-on-Avon from April 22 to 25. Delegates will register on the Tuesday afternoon and the programme will open with a civic reception.

Following an opening by the Mayor the delegates will be welcomed on the Wednesday by Miss K. M. Halpin, O.B.E., President, and Mr. G. le B. Diamond, C.B.E., Chairman, West Midlands Gas Board, and Miss P. Hornsby-Smith, Parliamentary Secretary of the Ministry of Health, will give an inaugural address. 'Food Hygiene' will be the subject of a morning paper by Dr. N. R. Beattie, M.D., a Principal Medical Officer of the Ministry of Health, and in the afternoon Miss Julia Clements will speak on 'Flower Decoration.' A dinner in celebration of the 17th anniversary of the Federation, will be given in the evening by the West Midlands Gas Board.

Two papers will be given on the Thursday morning, one on 'Hygiene in Practice in the Kitchen,' by Mr. W. A. G. Bradman, and the other on 'Food Hygiene as Applied to Shops,' by Mr. E. N. Wakelin, Birmingham, Chief Sanitary Inspector. The 17th annual general meeting in the afternoon will be addressed by Colonel H. C. Smith, Chairman of the Gas Council, Mr. Diamond, and Dame Vera Laughton Mathews, Adviser to the Gas Council on Women's Affairs; and Professor Winifred Cullis, C.B.E., will speak on 'Health in the Home.' The evening will be devoted to a visit to a performance of 'The Tempest' at the Shakespeare Memorial Theatre. Friday will be given up to a whole day visit to the Leamington works of Sidney Flavel & Co., Ltd., with alternative half-day visits to places of interest for those who must return early.

CONSULTATIVE COUNCILS

South Eastern Sales and Service

Mr. V. W. Stanton Outlines the Organisation

MR. V. W. STANTON, Commercial Manager of the South Eastern Gas Board, was due to address the Gas Consultative Council at its meeting on February 5 on 'Two-part Tariffs and Other Matters' but as the price of gas was under re-examination he dealt with the organisation of sales and service activities. He also replied to criticisms regarding the reconstruction of the Board's premises at Caterham. Mr. Stanton recalled that in an address to the Council last November, Mr. W. K. Hutchison said that it was the Board's aim to effect, as far as possible, complete decentralisation of consumer service arrangements so that contact between the consumer and the Board might be fully effective at local level. This decision was arrived at after very full consideration of the various forms of commercial organisation used by undertakings before vesting day.

Great differences in organisation were found, and the basis of the Board's proposed organisation was established in view of the efficient and economical service provided by the old South Suburban Company through comparatively small locally managed consumer service units. The problems of establishing this form of organisation were diverse and, owing to damage and destruction of premises during the war and the impossibility of replacing equipment of all kinds, the position at vesting day was that a large proportion of the Board's commercial premises were both inadequate and poorly equipped.

Preliminary Steps

This was in a number of cases recognised by the old undertakings who had taken some preliminary steps to effect improvements. For example, in the Metropolitan Division the South Metropolitan Company had bought a large site at Brixton Hill with the object of erecting a modern building for a consumer service unit serving the South Western district. The present scattered and inadequate premises used by commercial staffs in that district needed to be replaced as soon as possible but unfortunately restrictions inevitable in the present state of the national economy on work of this sort made it doubtful indeed when the Board would be able to give its district staffs the proper working conditions and adequate equipment which were necessary for economical and efficient working.

The Board had, however, considered it appropriate to embark on a number of comparatively small alterations and additions to premises in other parts of the area where by so doing the decentralised local consumer service units could be established. A good example of this was offered by the East Surrey Division. This consisted of the former districts of supply of the Croydon Gas Company, the East Surrey Gas Company, and the Horley Gas Company. The Horley Gas Company was very small, serving about 6,000 consumers. The East Surrey Gas Company had a decentralised sales and service organisation serving about 24,000 consumers. The Croydon Gas Company, serving 112,000 consumers, operated a large area of 75 sq. miles comprising three districts, and a great deal of sales and service work was concentrated at the Croydon Office.

In the northern part of the area it was essential that in order to provide self-contained service units some additional accommodation should be provided. A scheme was therefore prepared to make additions and alterations to a number of premises at present used as showrooms and, in some cases, district fitters' depots. Alterations were in progress to premises at Wallington which, as a self-contained service unit, would deal with some 46,000 consumers covering about 20 sq. miles. The Board had agreed that there should also be alterations to the commercial premises at Addiscombe, Carshalton, the William Cash Workshops at Purley Way, and at Caterham. In addition, work which was authorised at Coulsdon had already been completed but whether the present national position would allow of these other desirable changes was now open to considerable doubt.

Work at Caterham

The former use of the Caterham premises was as a showroom, a depot and stores for district fitters, and an office for the inspector and two inspector's clerks. The new system required that clerical duties in the preparation of fitters' work and the maintenance of records for 15,000 to 16,000 consumers be carried out at Caterham. A staff of eight clerks from the Croydon office was at present required for these duties and the space available at Caterham for office purposes was quite inadequate to house them. Additionally it was required that the prepayment meter collectors and index readers should work from the local office rather than from the district central office at Croydon, and some facilities had to be provided for this purpose.

There was only one way to provide the space required on the site available and that was to convert the single storey part of the premises at the rear into a two-storey building. The existing walls were not strong enough to built up. The roof trusses which were taken off had been used elsewhere on one of the Board's works and a pre-stressed concrete frame had been erected for the extension. It was decided to use this form of construction as while it was not cheaper than a normal concrete frame it economised in foundations, steel, timber, and cement.

When the work was completed it would provide extra office floor space of 1,066 sq. ft. for the district office plus an office for the district manager and a room to be used by fitters.

The Board was trying to bear as much as possible of the increased costs which were being forced on it and it was only by seeking more efficient and economical methods of working that that aim could be achieved. Changes in organisation which it had outlined had as their sole aim giving as good service to consumers in as economical a manner as possible, but these changes could not be made without adequate working facilities for district employees. It might well be that as the result of the present national crisis the Board would be unable to carry out its scheme as quickly as it had hoped and to this extent they must expect a degree of uneconomical working although every attempt would be made to effect economies, limited though these might necessarily be. As yet no steps had been taken to improve working conditions where they were poor if such improvements did not stand high in priority in the scheme of reorganisation.

Redistribution of Staff

Answering questions, Mr. Stanton said that as the result of the creation of the Board there had been a redistribution of staff and in some cases the accommodation was quite inadequate, but it did not follow that because certain members of the staff had been transferred from Croydon the accommodation there had become excessive.

Mentioning hire purchase, he said that as a result of the new control a certain number of the appliances supplied by the Board would have to be paid for in 18 months and the initial payment must be not less than 33⅓%. Hitherto the periods allowed had been two years for refrigerators and fires and three years for water heaters other than wash boilers. He was not unduly alarmed about the effects of the new control but remarked that he feared there were other consequences of the economic crisis that were likely to restrict the Board's business.

Since the beginning of 1951 the Board had been asked not to indulge in promotional advertising, but much useful propaganda had been carried on in regard to service and maintenance without hurting the susceptibilities of their competitors. Considerable publicity had been given to home service. The costs of publicity had been less than in normal circumstances, but he had no figures to give to the Council.

A lady member pointed out that sales were rising all the time and she thought too much money was being spent on advertising. Mr. Stanton replied that the Board must have regard to the cumulative and long-term effects of publicity.

On the question of guards for gas fires, Mr. Stanton said the present posi-

tion was that all the major suppliers would in future make guards as an integral part of panel and portable fires, and they would be incorporated with the fire. Guards would be available for fixed fires, and designs were in preparation. The difficulty at present was shortage of materials. When a guard was an integral part of a fire it became subject to purchase tax, and representations were now being made to the authorities with a view to some measure of relief. A number of guards were available in the Board's showrooms, but they did not completely conform to the British Standard specification. They were the best that were available, and in the course of time the Board would get better ones.

For old and existing fires it would be impossible to expect a large variety of guards to be available. In any case he suggested that there was always the nursery guard to which one could have recourse. He assured the Council that all new gas fires on sale or available would have guards.

Earlier in the meeting reference had been made to a resolution passed at a previous meeting on the desirability of gas fire guards. The Chairman, Councillor A. B. Constable, said the Board was fully in sympathy with the Council's ideas. A member said she had discussed the matter with a number of women's organisations. It was a matter to be dealt with in a Private Member's Bill, and she added that 600 letters had been written to Members of Parliament in the area.

Meetings Clash

Two or three members of the Consultative Council are also members of the London County Council, whose meetings are held on Tuesday—the day chosen for Consultative Council meetings—and therefore cannot attend one meeting without neglecting another. Possibilities of finding suitable alternative days were explored, but the outcome of a long process of voting was that the Consultative Council decided to adhere to the first Tuesday in the month for its meetings.

Another controversial question was whether or not members of the public should be admitted to meetings of the Council. Councillor Constable reported that other councils which had opened their doors to the public had met with poor response, usually not more than two persons being present. One South Eastern consumer had sought admission to a previous meeting and had been told that the Council had not yet decided the question of admission.

In view of the fact that the Council has booked a room for future meetings with sufficient capacity for two or three dozen spectators it was agreed to admit the public in future. One member thought London residents would enjoy an undue advantage unless the Council met occasionally in more remote parts of the area; another member was apprehensive of queues, but the Chairman said if there was a big rush it must be a case of 'first come first served.'

The question of right of entry—arising out of the Eastern Gas Board case last year—came up again. The Kent County Committee asked the Council to recommend that reply-paid registered letters should be sent to consumers before drastic action was taken. There was also a resolution put forward personally by a member of the Council who was also a member of the East Surrey Committee, which had referred consideration of the matter, to the effect that so far as collection of money from meters was concerned the Board should have recourse to civil law, and that right of entry should be exercised only in the other emergencies defined in the Gas Act.

After full discussion neither resolution was carried, the feeling apparently being that the Board could be relied on to exercise proper care in enforcing its rights.

New West Midlands Price Structure

UNDER a new price structure for gas in the West Midlands most consumers will have to pay more—approximately £1,000,000 throughout the area—due to additional costs of coal, transport, wages, salaries, oil, and other items. The new scheme framed by the Gas Board was considered on February 4 in private at a special meeting of the Gas Consultative Council under the chairmanship of Councillor W. H. Malcolm.

Mr. G. le B. Diamond, C.B.E., Chairman of the West Midlands Board, explained that of the alternative systems of charge, the principle of block rates, whereby successive reductions were given as the consumption increased, was considered the most suitable. This system enabled due allowances to be made in the block rates after the standing charges for such items as meter reading, account rendering, distribution charges, and other overheads had been met. But, while a uniform structure (with the exception of the South Staffs. Mond) had been followed, owing to the difference in production costs, it was inexpedient to adopt uniform prices. It was true that the tariffs in the North Thames area had been equalised but the economic and geographical circumstances in that area were exceptional. It was also true that the Midlands Electricity Board had followed this principle but the circumstances which followed centralised generation and transmission did not afford a true parallel.

Special Agreements

In special circumstances the Board would consider applications from very large consumers for a special price under agreement, but any special agreements entered into would require that the consumer should pay for all the blocks set out in the schedules up to 25,000 therms per quarter, and that the excess consumption only should be at the special rate.

In a minority of districts it was the practice to charge meter rents. It was proposed to abolish rents for primary meters of less than 700 cu.ft. per hour capacity. For some time past a rent had been charged on newly installed meters of and about the named capacity and it was proposed to continue this practice as and when such meters were fixed. Rents in respect of secondary and additional meters of all capacities would be continued where they were charged at present and would be extended to all such meters as from the date the tariffs were introduced.

No fixing charge would be made in respect of primary meters of less than 700 cu.ft. per hour capacity. In other cases, daywork charges would be made.

Prepayment Differentials

The price charged for gas to prepayment consumers would be the same as to ordinary consumers. Supplemental charges for the use of a cooker would be made. The supplemental charges would apply to cookers already installed, and the Board could not undertake to supply further cookers on these terms. All cash discounts for gas would be abolished.

All existing outer area price differentials would be abolished. There would be no inner or outer price zones at places like Dudley, Redditch, Stoke, Shrewsbury, etc.

Prices for gas for public lighting had been related to the prices charged in the respective districts and provided for a reduction from standard charges of 1d. per therm, or 4½d. per 1,000 cu.ft., as the case might be. Where the local authority desired the Board to be responsible for maintenance, charges would be based on uniform principles.

Effect on Revenue

In constructing the proposed tariffs, the broad aim had been to ensure the maintenance of existing revenue in relation to expenditure for the area as a whole but not to utilise their introduction as a means of augmentation. Nevertheless, it had been necessary to take into account substantial additional costs which had been imposed since the previous revision of prices. These new increases were entirely due to factors beyond the control of the Board and, in the aggregate, amounted to approximately 1d. per therm.

The general principle of charge was based on quarterly consumptions by one consumer in one premises but borderline cases occurred where adjacent or connecting premises would require adjudication. As the decision to be made must avoid either preference or prejudice, as between one consumer and another, standard criteria would be applied.

It was proposed that the tariffs should come into operation as from meter readings taken on, or next following, March 31. Additional charges set out in para. 5 will not, therefore, be recouped until the tariff is fully in operation. Owing to the system of continuous meter reading, this means that a full year's additional revenue will not be gained in the next financial year.

Mr. Diamond presented a statement showing, for each of the Board's districts, the additional amounts payable (per quarter and per week) by domestic prepayment and ordinary consumers under the proposed tariffs. The statement was based on quarterly consumptions of 30 therms and 45 therms respectively; 30 therms was the average quarterly consumption of prepayment consumers and 45 therms was the maximum consumption chargeable at the highest (block 1) price.

Prepayment consumers taking 30 therms per quarter would pay less in 14 districts and more in 50 than at present; credit consumers taking similar quantities would pay less in five districts and more in 61. At 45 therms per quarter prepayment consumers would gain in 14 districts and lose in 50; credit consumers would pay less in four and more in 62 districts.

Following the meeting of the Consultative Council the Chairman told the Press that the proposals for special tariffs framed by the Board had been adopted by the Council with one dissentient Mr. H. Baker (Secretary, Birmingham Trades Council). Mr. Diamond added further that the Board did not want to raise more revenue than it required but it wanted to balance income with expenditure and that meant it had nearly £1 mill. additional costs to meet. The same tariff structure was employed throughout the area but the application of the tariffs to the various areas was fixed by taking into account local production costs. In place of 71 different tariffs now in force they had telescoped the number to ten.

Mr. H. Baker in a statement after the meeting said in view of the economy cuts now being made by the Government it was more than ever necessary that consultative councils of nationalised industries should take the public into their confidence, and should be allowed ample time to examine proposals brought forward. The memorandum put before the council ran to 15 pages including five pages of tables and involved an extra charge for gas of nearly £1 mill. He protested that they should have been given more time for careful consideration of the memorandum. 'Consultative councils must not be allowed to become mere rubber stamps to decisions of the Board,' he concluded.

North Eastern Three-Zonal Tariff

AFTER three months' delay the North Eastern Gas Consultative Council on January 28 accepted the scheme proposed by the North Eastern Gas Board for fixing uniform scales of gas prices for three different zones instead of a single scale for the whole area. In October the Council referred the proposal back to the Board with a request that it should consider the introduction of a single tariff, and in November the Council was evenly divided and the Chairman declined to give a casting vote. At that meeting, however, approval was given to an increase in the general surcharge from 10% to 15% as from the December meter readings.

In its proposals submitted to the Consultative Council in October the Board stated that it had considered the division of the area into zones. There were a number of bases which might have been taken, but each had certain disadvantages, and among the possibilities rejected were those based on local government status, population, number of consumers, and annual gas sales.

There was one major factor in gas production, the delivered cost of coal—and the Board felt that zones based on such a factor would give a common reflection throughout the districts. It was decided to take a central point in the coalfields from which the bulk of supplies were drawn. The delivery charges were taken to three limits, the second having a margin of 5s. per ton over the first and the third covering the remainder. An additional point in favour of the adoption of three zones was the fact that it followed a general pattern which could be seen running through existing gas prices in that there was a tendency for increasingly higher charges to be made as the distance of individual undertakings from the coalfields increased.

The zones are: Zone 1: Leeds, Bradford, and 27 neighbouring undertakings: Zone 2: York, Harrogate, and 21 others: Zone 3: Scarborough, Whitby, and 18 others. The tariffs proposed by the Board in October were as follows:

Therms per quarter			Zone 1 Gross d.	Zone 2 Gross d.	Zone 3 Gross d.
First	25	... ...	18.00	18.75	19.50
Next	40	... ...	16.00	16.75	17.50
,,	60	... ...	14.75	15.50	16.25
,,	375	... ...	13.50	14.25	15.00
,,	750	... ...	12.50	13.25	14.00
,,	1,250	... ...	12.00	12.75	13.00
,,	2,500	... ...	11.50	12.25	13.00
,,	7,500	... ...	10.50	11.25	12.00
Excess	...	... ...	10.50	11.25	12.00

Main points of the Board's proposals were summarised as follows: (a) A uniform block rate throughout the area; (b) area to be divided into three zones, the charge for gas to be uniform within the zones; (c) main meter rents to be abolished; (d) discount of 5% to ordinary consumers for payment within 28 days; (e) prepayment differential of 1d. per therm for first 100 therms per annum; (f) minimum charges on a quarterly basis according to size of main meter installed where the normal charge for gas does not reach such minimum.

Addressing the January meeting, Dr. R. S. Edwards, Chairman of the Board, referred to the adverse effects of the recent increase of 6s. 3d. per ton in the cost of coal and of 1s. 0¼d. per ton in respect of freight and said that while the Board was conscious of the effect on consumers of continued increases in charges it had been compelled by economic conditions to adjust the level of charges. It was now proposed to make an all round increase of three farthings per therm above the tariffs previously proposed.

'A further warning note must be made in this connection,' said Dr. Edwards, 'in view of the fact that we are still in an era of expanding costs and uncertain economic trends.'

The three-zonal tariff, including the additional three farthings per therm, was accepted by 11 votes to six. The increases are expected to take effect before April 1.

Record Output at Sunderland

MR. W. O. KIRKWOOD, General Manager of the Sunderland Division of the Northern Gas Board, told the Divisional Consumer Committee on February 4 that the output of gas at Sunderland is steadily increasing and during January the total gas delivered was 296 mill. cu.ft. This represents a 4.24% increase compared with January, 1951. The output of gas for the week ended January 31 was over 70 mill. cu.ft., which was an all-time record at Sunderland. All available plant was at work and every effort was made to maintain gas pressures throughout the area.

During December a medium pressure gas supply was laid on to Thorney Close and Pennywell housing estates where approximately 20,000 people have been housed recently. Mr. Kirkwood reported that gas pressures to the estates were now highly satisfactory. It was hoped to start laying a new 12 in. low pressure steel main within the next two months to Hylton Red House, another Sunderland Corporation estate, upon which construction has begun and where 5,000 people will live.

Referring to the position in the Ryhope district, Mr. Kirkwood said that pressure from December last year had been augmented by a high pressure gas supply taken from the Sunderland-Seaham main and in this district, too, satisfactory pressure conditions were obtaining.

The Divisional General Manager reported that Town and Country Planning Authority had been obtained after 12 months' negotiation for the provision of an additional gasholder at Washington, and the contract was now awaiting final authorisation from the Ministry of Fuel and Power.

A new showroom in Station Road, Seaham, is now being decorated and will be brought into use in mid-February. Mr. Kirkwood said that 30% increased production would be achieved at Consett by the end of the month due to the completion of new carbonising plant. The proposed 6 in. main from Chester-le-Street to Graghead might be unavoidably delayed owing to the long delivery periods for materials. In connection with the laying of the Gilesgate main at the Durham unit, steel pipes are being transferred from West Hartlepool and it is hoped that the laying of this main will commence within the next two months.

The progress of many of the improvement schemes will be affected by the shortage of steel and cast iron pipes, but the more important schemes will be carried out as quickly as possible.

BACKGROUND of APPLIANCE DESIGN

By HAROLD HARTLEY, D.Sc., Hon. M.Inst.Gas E.,
Chairman, Radiation Ltd.

The following is from a paper given to the Australian Gas Institute at the annual meeting and convention in Melbourne, November 1951.

GOOD design may be described as a solution of the problem of producing appliances at the same time constructionally, functionally, and aesthetically satisfactory in anything made by man for man's use. In defining good industrial design a qualification has to be introduced that it must represent such a result as is capable of quantity production by mechanical means.

The work involved necessitates co-operative action by a series of specialists who constitute a design team. Their work must be co-ordinated so as to impart balance and ensure that the views of each member of the team are given due weight. In this way there can be attained that essential uniformity of conception which is necessary for a well-designed appliance. Different facets of design can be singled out as being of greater or less importance in different circumstances.

Visual Design

Visual design has an important bearing on the reaction of the public to the apparatus, and effort is being made to put the problems of visual design on a more coherent and logical basis than has been the case in the past. Experience has shown that a purely functional approach does not always yield an acceptable result and something more is needed. While it is not possible to dismiss the vagaries of fashion from any consideration, certain trends can be distinguished which it is the responsibility of the competent artist-technician to encourage. There is a characteristic permanence about good design in the sense that it satisfies for long periods.

Everyone tends to defend his choice with greater or less skill, depending on his knowledge and intellectual equipment, but it must be remembered that in the last resort, for the products of modern industry, it is the customer, representing the majority taste, who is the final arbiter. Without guidance the majority taste may reject what is new simply because it is unfamiliar, and at times there arises a need for education. Despite the slogan to the contrary, it is true to say that the customer is not always right and the public does not always know what it needs. Standards of safety, efficiency, and hygiene have been established as the outcome of experience which the public cannot possess. Standards have to be maintained in the field of aesthetics so that the public may acquire a liking for good form and an appreciation of its permanence. The work of education has to be directed to the developing of a true sense of quality, and good form is only one factor, however important, in good quality. Ultimately the project will be judged by the extent to which all aspects are integrated into a coherent whole.

Technical Design

This aspect of design is generally less obvious to the layman. It is of prime importance, embracing as it does considerations of completeness of combustion, efficiency of heat transfer, standards of performance, ease of operation, as well as economy in space occupied and materials used to fulfil the given requirements.

Rapid progress has resulted from the thorough-going application of scientific principles. Under modern conditions each detail is subjected to an intensive development process in which the various factors influencing its fitness for the job to be performed are given consideration. This applies not only to the design as a whole, but also to the durability of the parts which are subjected to mechanical, thermal, or corrosive influences. We have moved past the stage of mere empirical design to a phase in which, once the objective is defined, a satisfactory solution may be laid down with a minimum of trial and error. Nevertheless, in view of the nature of the problems, it is unlikely that the empirical process will ever be eliminated. Of the many factors which enter into technical design, three may be mentioned because of their importance.

(a) Influence of Gas Quality.

As performance standards are raised, be they concerned with thermal efficiency, combustion requirements, or cooking quality, the attainment of flexibility becomes increasingly difficult. Dimensional accuracy becomes of even greater importance, as does uniformity of gas supply. In the present connection the term 'flexibility' is used as meaning the ability to burn gases of widely differing combustion characteristics without readjustment, and the ability to obtain consistent performance without the need for undue care.

In Great Britain progress is being effected towards the standardisation of a relatively small range of essential characteristics. In considering combustion, the behaviour of an aerated-flame appliance may be represented conveniently by a combustion diagram, which shows in graphical form the range of conditions over which stable and complete combustion can be maintained.

In assessing the effects of gas quality changes, it is necessary to have some scale of comparison of different town gas supplies. The Aeration Test Burner is helpful in this respect. Unfortunately the instrument has an arbitrary scale, and to attain comparable results at different centres, each burner must be calibrated against a master standard. M. P. Delbourg in France has developed a test burner which also indicates back-fire and blow-off limits. This burner also has an arbitrary scale.

A knowledge of the amount of air needed for complete combustion of the gas is fundamental, and this may be gained easily and accurately with the Total Air Requirement burner. A change in the amount of air required for complete combustion may have an important bearing on the combustion standard attained.

To enable the fitter to adjust appliances satisfactorily, a simple means of taking account of variations in gas quality is provided by the Flame Matching Burner.

Under the conditions prevailing in Great Britain it has been possible to make considerable use of non-aerated burners in certain domestic appliances. These have advantages particularly in respect of the choking of the air inlets or burner ports by air-borne dust, fluff, etc. The effects of gas quality on such burners are, however, more difficult to analyse than in the case of the aerated type. At the present time an effort is being made to establish a satisfactory criterion of quality applicable to non-aerated flame burners.

By the study of the effects of changes in gas quality and of appliance characteristics on the range of flame stability in normal and in polluted atmospheres, valuable information is being accumulated which will be of direct use in designing the apparatus of the future.

(*b*) *Completeness of Combustion.*

It is difficult to realise that until 1926 no satisfactory quantitative method was available for routine measurements of completeness of combustion in gas appliances. Since that date the importance of such measurements from a safety aspect has been realised generally and all gas-using countries have established recognised standards to which gas appliances must conform, usually under severe overload conditions. Reference has been made earlier to the influence of variations in gas quality. In many instances wider margins of tolerance are needed, especially when the functioning of appliances in vitiated atmospheres is taken into account.

Disposal of Products of Combustion.

The disposal of products of combustion remains a factor tending to put limits on the use of gas in the home. The principles of design of satisfactory flue systems are now generally well known, but at times the expense of installing the apparatus adds appreciably to the prime cost which the consumer has to face. Flue systems may bring their own problems of condensation and corrosion. Where condensation is persistent the most satisfactory arrangement compatable with reasonable cost is an insulated mild steel pipe completely protected by a corrosion-resisting coating of vitreous enamel or other material. The small heat capacity combined with acid resistance ensures a satisfactory degree of durability.

The flueless gas appliance would have had a new lease of life had the recommendations regarding the reduction of the sulphur content of town gas been implemented.

Operational and Functional Design

The user is most conscious of this aspect of design as it determines the suitability of the appliance for his particular needs.

When studying the behaviour of apparatus in a laboratory, the conditions can be controlled and the effects of variables studied one by one. If an attempt is made to investigate the results attained in domestic use, such control is not possible and the statistical methods of operational research are needed. The necessary investigations would be laborious, and on the whole it is better that investigation of functional problems be done under laboratory conditions.

A related activity, 'market research,' is intended to guide a sales organisation in its endeavour to meet public demand to the fullest extent with a limited range of apparatus. Market research can disclose conditions which call for urgent action; for example, that in Great Britain half the houses have no piped hot water supply. Market research can also be of value in ascertaining the opinions of consumers on appliances which they have in use, and may lead to desirable modifications. The layman, however, can only know of the possibilities of gas as a fuel within his own small orbit of experience, while the appliance designer has both a selective and an educative function to perform. Market research cannot be expected to give reliable guidance to the designer in his attempt to open up a completely new field or to introduce modifications with which the public are not familiar. The initiative in new ideas usually comes from those trained and engaged in the industry, and must be based on facts derived from scientifically controlled investigations.

Under modern conditions, standards of comfort and hygiene are changing continually. It is the responsibility of the appliance designer not merely to follow but to anticipate and encourage trends which represent real progress in the amenities of civilised life. Here there is need to see that the lay public shall be taught to distinguish between meretricious features, which at times are introduced as novelties, and the carefully evolved characteristics which are of more permanent value.

The above trend of thought has far-reaching implications. Domestic tasks need to be studied from the point of view of economy of effort—that is, on the same basis as time and motion study in factories. This does not, of course, imply any attempt to force the housewife into a preconceived mould or habit; any such study must take account of the diversity of household characteristics. By such means it is possible to specify the procedures for which appliances have to be designed, so as to limit the range of conditions which must be satisfied by the designer. It can be shown that household needs—*e.g.*, for hot water—can be met by a relatively small number of units the combination of which in various ways offers the necessary flexibility. Superficially it might seem that the user benefits if there is a great variety of appliances in each category from which to choose. Actually such freedom of choice may be dearly bought, as the complications which result can have a substantial effect upon the overall cost of the apparatus.

A relatively small range of carefully designed appliances, each made in sufficient numbers to permit of the full advantages of specialisation being obtained, can give the consumer better value for his money.

It is my belief that the application of the line of approach will continue to open up fields of progress in domestic amenities and in the design of apparatus to meet both present and future needs.

Constructional Design

While the method of construction is of prime importance to the manufacturer, it is also of importance to the consumer in its effect on costs. It is a *sine qua non* that any appliance must be of durable structure and that care must be taken to ensure that the working parts especially will last. If the appliance is finished in vitreous enamel, then these enamels must be capable of resisting thermal shocks and the attack of the dilute acids which occur in certain foodstuffs. The mechanical aspects of design not only affect production, but they influence durability as well as the cost of maintenance. The size of the potential market is a major factor, as it may determine the most economical manufacturing method. For example, unless there is likely to be a big demand, it may not pay to use a construction for which costly tooling is involved.

A compromise is generally necessary between what is technically or aesthetically desirable and what is economically possible. In the design teams there are members responsible for technical details, others for aesthetic considerations, as well as sales representatives and production specialists. It is the responsibility of the latter to ensure that there shall be an economic use of materials, and that the best possible advantage shall be taken of the existing manufacturing facilities. It is for them to see that new manufacturing techniques are introduced when practicable. While it is essential that design teams shall take full advantage of data which have accumulated as the result of years of experience, they must never feel that their experience makes them self-sufficient. They have to explore new avenues continually for possible improvements, and keep aware of the advances that are taking place in other fields of activity, always with the object of ensuring that the apparatus which is made shall be the best possible in the particular field of application.

Future Prospects

There has been striking progress in the last 30 years in increasing the thermal efficiency of appliances. It seems, however, that improvement along the present lines is approaching the practical limit, and further substantial progress must be sought in new directions. For example, on the cooker hotplate, drastic change in design may be involved which will necessitate popular education in the use of equipment. In

(*Concluded on p. 429*)

South Western Section, I. G. E.

Causes and Prevention of CORROSION

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FROM the practical point of view, the more important factors which influence corrosion are: Contact of dissimilar metals; non-uniformity of the metal, whether due to impurities or to segregation; presence of oxygen in the surrounding medium; internal stresses in metals; stray electric currents, which often assist in the destruction of gas and water mains; elevated temperatures.

The corrosion of metals exposed to the air seems to depend on the formation of a film of moisture on the metal surface, because if this is prevented—for instance, by keeping the temperature of the metal above the dew-point—corrosion is greatly reduced. In the case of iron, protection is often provided by coating it with another metal such as zinc, copper, nickel, or tin. The protection afforded differs in kind, according to whether the covering metal comes above or below the foundation metal in the electrochemical series. Two examples will illustrate this important point.

Iron is frequently 'galvanised' or covered with zinc, a metal more electro-positive than iron. Rusting, which is always due to the presence of ferrous ions in the liquid in contact with the iron surface, is thus prevented and the zinc coating is sacrificed until no more remains. If, however, the iron is coated with tin, as in 'tinplate,' perforation of the coating leads to rusting, because iron is more electro-positive than tin and therefore has a greater tendency to form ions, so that the metallic iron dissolves from the exposed part and hydrogen is given off from the tin, while electrons flow through the metal from iron to tin.

Mill-Scale

Let us now turn to what may be termed non-uniformity of the metal, and deal with mill-scale. If iron is in contact with a more anodic metal, such as zinc, the zinc will corrode preferentially and, within its sphere of influence, protect the iron by its sacrifice. But when iron is in contact with a more cathodic metal, or other conducting material, attack may occur unless the cathodic material forms an impermeable layer over the whole of the iron surface. For example, mill-scale is cathodic to iron and can give rise to considerable localised corrosion in service, particularly when it is only partially removed, as by incomplete weathering.

If the mill-scale could be kept intact, good protection would result and such a surface would be a suitable base for painting. Broken mill-scale, however, is most dangerous from the point of view of corrosion, and the attack will be localised at those parts of the surface where the scale is absent or weakened, thus producing serious pitting. Pitting may result in actual perforation of the metal whereas the same amount of corrosion spread over the whole surface might be quite harmless from an industrial standpoint.

Many other interesting cases could be cited, such as the de-zincification of brass, which used to be a grave problem for marine engineers, and the 'graphitisation' of cast iron in sea water or certain soils. There is also a very large literature dealing with surface films, and this aspect will be touched upon when we deal with preventive measures.

In regard to oxygen in the surrounding medium, the underlying principle is explained by the differential aeration theory. Here again many practical examples could be given, but one must suffice. In the case of water-cooled condensers, used for cooling various industrial gases, corrosion by differential aeration often constitutes a problem, and it is always advisable to avoid free air entering with the cooling water and also to allow a free vent for any air given off due to temperature rise. A special form of this type of attack is that known as 'hidden area' corrosion which often occurs under mud deposits and which is reduced or prevented by the insertion of a sand filter in the water supply line.

We turn now to internal stresses in metals. The chief point to be noted is that this is really an extension of the 'dissimilar metals' idea, except that, paradoxically, it must be emphasised that different metals need not be present, because iron which has been stressed is anodic to unstressed iron. This is one of the reasons for the modern stress relieving technique.

The question of stray electric currents could alone supply sufficient material for a paper, but the essential aspects will be dealt with under preventive measures.

The oxidation of metals at high temperatures is a matter of particular importance in chemical engineering in connection with distilling, retorting, roasting, and sintering plant.

Oxide Films

Most of the common metals give, on heating in air, a layer of oxide which covers the surface, but even at ordinary temperatures there is usually an oxide layer, though it may be too thin to be seen. In general, the rate of diffusion of oxygen through a film on the surface is inversely proportional to the thickness of the film, so that the further oxidation proceeds the slower is its rate. An invisible film at ordinary temperatures may be thick enough to prevent the further diffusion of oxygen, but at higher temperatures a much thicker film may be built up before the rate of growth becomes negligible.

It is possible to divide metals into two classes according to the relationship between the volume of oxide and that of the metal which gave it. For most of the lighter metals, except aluminium, the oxide occupies a smaller volume than the original metal. The oxide film is, therefore, porous and does not obstruct the further oxidation of the metal, even at low temperatures. Thus sodium, calcium, and magnesium burn in air.

A heavier metal oxide of the second class occupies a laregr volume than that of the metal itself and the film is, therefore, non-porous.

If the oxide occupies a volume considerably greater than the metal, the increased compression may cause the film to crack and peel off. When an oxide film of sufficient thickness forms it exhibits 'interference colours' with reflected light, such as one sees, or used to see, on copper steam pipes. Interference tints may be first seen when the film is about 400A° (1 angstrom = 10^{-8} cm.). It used to be the practice, when tempering steel, to use the interference colour as an indication of the temperature to which the metal had been heated, but

the method is not entirely satisfactory because a short heating at a high temperature may produce the same thickness of oxide layer as a prolonged heating at a lower temperature.

It will be obvious that the various factors listed as influencing corrosion represent only a small part of the whole story, and before turning to preventive measures several other points must receive brief attention.

Secondary Reactions

In the first place, pure dry air at ordinary temperature does not attack metals seriously, except the more active ones such sodium and calcium; but even if a thin film of dew is condensed on a metal surface then electrolytic corrosion can occur in a similar manner to that which occurs in solution. But a thin film of dew is likely to be well supplied with oxygen, so that the main factor controlling the reactions will not be the supply of oxygen, as in the case of a specimen immersed in a solution, but rather the presence of electrolytes in the film itself. These increase the conductivity and therefore the corrosion rate. Once corrosion has started it may be increased by secondary reactions. Thus, if the salt formed is hygroscopic, more water will be absorbed and drops will collect on the surface. This is sometimes seen in rusting when the red surface has numerous drops of liquid on it. The essential difference between the effect of complete exposure to the weather and of exposure to indoor atmospheres of high relative humidity lies in the influence of rain. Thus, it may increase the rate of attack by the removal of a more or less protective coating or, conversely, it may reduce the rate of attack if the corrosion product is acid or hygroscopic in character, as with nickel.

In this country rain-water usually contains dissolved sulphates and, in industrial districts, traces of free sulphuric acid, so that a characteristic constituent of atmospheric corrosion products is either the normal or basic metallic sulphate, although near the seaboard the normal or basic chloride may predominate.

The characteristic green patina which forms on copper after prolonged exposure was formerly thought to consist of basic copper carbonate, but Vernon has shown it to consist of basic copper sulphate. The basicity of the product increases progressively with time and ultimately after, say, 70 to 100 years exposure, its composition is identical with that of the mineral brochantite ($Cu\ SO_4\ .\ 3\ Cu\ (OH)_2$). A process has been patented whereby a green patina of basic sulphate may be produced on new copper by an anodic treatment of 15 min. in an electrolyte containing sulphates and an oxidising agent.

The atmosphere of industrial districts is seldom clean, and particles of various substances, in the presence of traces of sulphur dioxide, have a considerable bearing on the rate of rusting of iron.

The presence of sulphur dioxide, from the burning of fuels, is also a potential danger in steam raising plants, particularly in connection with economisers and waste heat boilers. In the presence of iron oxide some of the sulphide dioxide is catalysed to sulphur trioxide, so that if any portion of the plant falls below the dew-point of sulphuric acid (say 250° to 350°F. depending upon the amount of water vapour in the gases) violent corrosion may occur.

Corrosion of Non-ferrous Metals

It might be expected that the rate of corrosion would be determined by the magnitude of the effort on the part of any particular metal to 'get back to nature.' However, in immersed corrosion the rate of attack is frequently controlled by the rate at which oxygen can diffuse to the metal, and at other times by the properties of the initially formed corrosion product. In atmospheric corrosion this latter factor becomes predominant and, in the case of non-ferrous metals, one has to consider whether the compound formed is soluble or insoluble in the solution. For example, in the case of plumbo-solvency, lead pipes are not attacked by hard water containing bicarbonates or sulphates, because these form insoluble protective films. Magnesium, although an active metal, forms a protective film of $Mg(OH)_2$ insoluble in water, but magnesium is attacked by sea-water because the chlorine ion causes the film to break down. Aluminium is not corroded in air or water because of the very protective film of alumina (Al_2O_3). Many other instances could be found.

In the atmospheric corrosion of various metals, three main cases have been recognised each of which is characterised by the type of curve obtained when corrosion is plotted against time.

Type 1 is shown by copper tarnishing in an indoor atmosphere. In this case the rate of attack falls off with increasing time. As would be expected, the photomicrograph shows the reaction product in the form of a continuous layer.

Type 2 is shown by zinc exposed to an indoor atmosphere. The rate of attack remains constant—actually over a period of several years—and the product is shown to be granular so that penetration is regular through the interstices.

Type 3 is shown by iron, in which case the rate of attack increases with time and the corrosion product is completely discontinuous, a fact which differentiates iron sharply, and to its disadvantage, from the other well-known metals.

Damage to Buildings

Any attempt to survey the whole field of corrosion would be incomplete if restricted to attack upon metallic structures alone. We have many beautiful buildings in this country, but much of the masonry has been badly attacked by atmospheric corrosion. It has been estimated that such attack on public buildings has cost this nation about £60 mill. over a period of 25 years.

Much more could be done in the matter of reducing the pollution of the air by sulphur acids. This pollution is due largely, in the first place, to pyrites in coal. During the recent war period, up to the end of September, 1945, the total recovery in this country of coal pyrites amounted to over 115,000 tons. The pyrites contained 40% to 42% sulphur, against 48% in the best imported material, and, although it provided less than 5% of the total requirements of the acid trade, it saved shipping space and foreign exchange, in addition to saving sulphur, as brimstone. Being removed from the coal, it also prevented the emission of the equivalent of about 144,000 tons of 100% sulphuric acid into the atmosphere.

The soot present in smoke, apart from causing disfiguration, contributes to chemical attack because it carries with it free acids and soluble salts which it brings into intimate contact with the stone and so disintegration proceeds.

There exists a group of compounds known as silicon esters. One of them, ethyl silicate, has been in use over a number of years for the preservation of artistic and architectural stonework. It is known in this country as 'Silicaseal.' When applied to a porous surface, such as stone or concrete, it penetrates and hydrolyses, and silica gel is deposited in the pores. The gel subsequently hardens to pure amorphous silica, very much like natural opal or agate.

Protection Against Corrosion

Preventive measures are often blamed unfairly for diminishing resistance to corrosion when the trouble is really due to bad design. Details such as gusset plates, stiffeners, and corners, where water and grit tend to collect, should wherever possible be designed to avoid such lodgement.

The amount of money spent annually on protective schemes for ferrous structures is prodigious, and yet the damage caused by rust still gives rise to grave concern.

The chief ways for prevention may be classified as: The use of protective coatings; the use of specially resistant materials; neutralisation or removal of the active substances; the use of counteracting electrochemical expedients (*e.g.*, the introduction of metallic zinc into steam boilers).

(*Continued on p. 419*)

The following notes given some idea of the more important protective coatings.

(a) *Bower-Barff Process.*—Iron or steel is heated by 900°C. and a protective coating of magnetic oxide, formed by exposing the heated material to super-heated steam, and afterwards to coal gas to reduce any Fe_2O_3 to Fe_3O_4, is produced. There is the disadvantage that a slight enlargement takes place and the relatively high temperature often warps the articles.

(b) *Coslettising Process.*—Thomas Watts Coslett invented this in 1907. A rust resisting film of iron phosphate is formed on iron or steel by boiling for about ½ hour in phosphoric acid solution saturated with ferrous phosphate. The *Parker Process* also uses phosphoric acid and various phosphates. There are various other processes having their own trade names.

(c) *Anodising Process.*—This is applied to aluminium and its alloys. Produces an impervious film of fine-textured adherent oxide. The articles to be treated are made the anodes in a bath containing chromic acid—in some cases 3%. The cathodes are of stainless steel

(d) *Sherardising Process.*—A film of iron/zinc alloy is formed. It may be highly polished afterwards and chromium-plated (chrome sherardising).

(e) *Calorising Process.*—This consists of heating metals to 900°C. in stationary or rotary retorts in contact with finely-divided aluminium in an atmosphere of hydrogen. Duration varies according to degree of penetration desired.

(f) *Nitriding* (*Nitralloy*) *Process.*—This employs nitrogen to produce a hard casing. Ammonia gas is used and it dissociates in contact with steel at 500°C. Fe_4N is formed. Special steels containing Al, Cr, or Mo form a thicker case and are more readily treated.

(g) *Metallising* (*Metal Spraying*).—Atomised particles of the molten metal are sprayed from a pistol on to the surface to be treated. Cloth, wood, and metal can be readily coated. A sprayed coating of zinc 0.004 in. thick is said to give protection equivalent to that of the best hot-dip galvanising. The early experimenters—Allen, Thurston, Schoop, and others—attempted to use powdered metals, but failed because the powder clogged. Schori draws the powder from a separate container by means of a stream of air. The latest type of pistol will spray at the rate of 250 sq. ft. per hour. The powder is graded so that the particles are almost identical in size and so absorb an equal amount of heat when passing through the flame, thus giving a dense layer which is remarkably free from oxide and which bonds with great tenacity—so much so that sheet metal which has been sprayed with a protective coating of Zn, Cu, Al, or other metal can be hammered, riveted, or even bent.

(h) *Fescolising.*—This is a method of electro-deposition much used for building up worn parts of machinery. Ni, Cr, Cd, Cu, and Pb are used. For new parts and protection against corrosion the deposits are usually 0.001 in. to 0.005 in. thick.

(i) *Electro-Deposition.*—Cadmium has proved more useful than zinc for the protection of iron and steel, owing to the greater inertness of its oxide. It has also given good results on aircraft alloys.

Protection by Paints

Every year in this country alone some 40 mill. gal. of paint is used on iron and steel and much of it is wasted due to inadequate preparation of surfaces or its application under unsuitable conditions. If the work is properly carried out, it is probably fair to state that from half to two-thirds of the cost of painting a steel structure is entailed in the proper preparation of the surface.

If paint is applied to steel having a substantial layer of mill-scale a great deal of the scale will eventually flake off, removing the paint and leaving bare steel exposed to corrosive conditions. Investigations have proved that mill-scale is largely responsible for pitting. Mill-scale, or magnetic iron oxide (Fe_3O_4), has a more positive electrode potential than iron itself and, therefore, by reason of its area in comparison with the size of area of potential difference normally met with, exercises a strong cathodic influence over the iron, which then corrodes.

A badly prepared surface can result in such a rapid breakdown of paint that its quality is often wrongly suspected. The requirements for surface preparation may be summarised as follows:—

(a) Moisture, whether physically adsorbed or chemically combined, should not be allowed to remain below the primer. It may destroy the adhesive bond between paint and metal and thus lead to early paint failure.

(b) Corrosion products and other foreign matter should be completely removed before the primer is applied.

(c) Mill-scale should be completely removed if possible. Failing this, any unbonded scale must definitely go.

Preparation is most widely done by pneumatic or hand chipping and wire brushing. Sand blasting, acid pickling, or phosphating methods are also used. A more recent procedure is the flame cleaning process. The manipulation of the equipment requires no particular skill, and anyone having a working knowledge of oxy-acetylene apparatus can operate the blowpipe with confidence. The operation consists of passing the flame over, and close to, the surface of the metal. As a result, all unbonded mill-scale, corrosion products, and occluded moisture are either driven off or so loosened as to be easily removable by wire brushing. There is an advantage in painting on a warm surface so long as the temperature does not exceed, say, 100°F. The question of the possibility of distortion due to flame cleaning requires consideration, but as the maximum temperature, with reasonable care, is not likely to exceed 250°F. there would seem to be a considerable margin of safety, because there is no appreciable effect upon steel up to 600°F. Dust and gases seldom cause a hazard out of doors, but in other cases a respirator should be worn. Various papers have been read giving costs and other particulars, and these may be consulted. ('Flame Cleaning of Structural Steel,' F. H. Dill, *Welding Journal*, April, 1941, W. G. Theisinger, *Oil Gas Journal*, 1948, **46**, 275).

There is much misconception relating to paint because the durability of a paint film as such does not exist; a complete system is involved—namely, base material/paint/environment. This also includes atmospheric conditions during the early stages of drying. It is very difficult to reproduce all the variables in exposure tests. The chief variables are:—

(a) General character of the paint and of its separate constituents.
(b) Its manner of application.
(c) The nature of the metal/paint interface and the structure and physical state of the metal.
(d) Character of the environment.

The method of application of paint is particularly important. An otherwise suitable paint applied to a badly prepared surface usually results in premature failure.

Dr. Jordan and Dr. Whitby, of the Paint Research Station, have expressed the view that, of all the complicated factors operating during the application period, and governing the result in terms of durability, the most important is the prevailing atmospheric condition from the moment of spreading the paint to the time the film has set and begun to harden. They also warn against a possible cooling effect and the probable deposition of moisture when spraying paint, especially under conditions of high relative humidity of the atmosphere. In general, brush work is more satisfactory than spray, and two or more thin coats are better than one thick one.

Functions of Primer and Finishing Coats

The use of red lead as a priming coat for iron dates back far enough for its origin to be obscure, but excellent results were obtained with it long before any serious consideration

was given to the cause of such protection, and red lead still provides the standard of reference for anti-corrosive material.

Nowadays, priming coats are frequently compounded with one or more inhibitive pigments so that in the event of a limited breakdown in the paint layer corrosion is retarded. Such priming coats usually possess poor water-excluding properties, and therefore the finishing coats are designed to give good exclusion while electrochemical protection is left to the primer. The performance of the primer, however, is largely dependent upon its intimate contact with, and adherence to, the surface of the metal, and, once again, upon the conditions under which it is applied.

Specially Resistant Materials

This is a very wide field, but one or two examples may be given.

Stainless steels fall into two chief classes—those which harden on quenching in water and those which do not. The first, and simpler, class contains 0.1% to 0.3% carbon and 12% to 14% chromium. Alloys with less than 0.1% carbon are usually called stainless irons. The second, and more costly, type of stainless steel contains 15% to 20% chromium and 7% nickel. Stainless steels working in contact with graphite packing tend to suffer from pitting, while care has also to be taken when welding them, because resistance to corrosion may be diminished due to carbide separation at the grain boundaries in the neighbourhood of the weld.

The essential difference between ordinary and stainless steel lies in the self-healing property that is conferred on the invisible oxide film by the presence of the chromium in the alloy.

For ordinary structural work, copper steels (0.25% to 0.5% copper) are coming into use, and they give increased resistance to corrosion in highly polluted atmospheres, although they are much inferior to the rustless steels. Copper/molybdenum ingot iron (0.45% copper and 0.07% molybdenum) also offers increased resistance to atmospheric attack. Many people believe that the substitution of mild steel for wrought iron rivets in modern practice has had an adverse effect from the standpoint of corrosion, but, provided the composition of the rivets is properly chosen in relation to that of the plates, the use of steel would not be expected to introduce any disturbing factors. The rivets should be slightly cathodic to—that is, less attacked than—the plates, since a more generally distributed corrosion on the plates is preferable to a localised attack on the rivets, and the use of copper steel has been suggested for rivets because it is slightly cathodic to ordinary mild steel when the two are in contact.

Clad steels are used extensively in petroleum refinery equipment because of their resistance to corrosion and lower cost, without sacrifice of structural strength. Such steels consist of a light layer of corrosion-resisting metal, such as stainless steel or monel metal, bonded to a heavier backing of steel.

Lastly, mention may be made of 'prosthetic alloys' (*e.g.*, 0.09% carbon, 18% chromium, 13% nickel, 2.5% molybdenum, and the balance iron) in which non-toxicity is the major requirement. Such alloys have been found to be inert and to have little tendency to pit during long exposure in the body.

Underground Corrosion

The points so far dealt with, while common to all forms and locations of structure, apply particularly to what may be termed atmospheric corrosion. The two remaining items—namely the neutralisation or removal of active substances and the use of counteracting electrochemical expedients, excluding such methods as inhibitors in paints—apply with particular force to underwater and underground corrosion and to attack in steam and hot water systems.

The protection of machined steel surfaces under highly humid conditions of storage has been achieved by the use of textile and paper wrappings impregnated with sodium benzoate, thus dispensing with the use of grease or wax. This technique was developed by the D.S.I.R. Rubber coatings, which are readily peeled off when desired, may also be used, and are made by immersing the article to be protected in rubber latex suitably treated with sodium benzoate and sodium nitrite.

The protection of metals against underground corrosion involves all the usual troubles found in atmospheric corrosion, together with the additional hazards of attack by bacteria and stray electric currents. It is not proposed here to go deeply into the question of electrolysis and corrosion due to leakage, particularly from D.C. plant, but in dealing with cases of electrolysis the question frequently arises as to whether Faraday's laws are strictly obeyed. Radley and Richards have shown that if due allowance is made for both chemical corrosion and electrolysis, which can take place together, the laws apply.

In view of the large programmes envisaged for underground gas and water mains and services, the problems of underground corrosion and its prevention is one of major importance. It has probably received more study in the U.S.A. than elsewhere because, among other factors, in that country there are more than 125,000 miles of buried pipes used for the transport of petroleum and its products. Recently considerable work has been done at home, particularly in an endeavour to afford guidance to those responsible for pipelines. ('Underground Corrosion of Metals,' K. R. Butlin and W. H. J. Vernon, *J. Inst. Water Engineers*, 1949, *3*, No. 8, 627.) When dealing with underground corrosion under practical working conditions it is usually only possible to apply general principles because an investigation of soil conditions in a trench by chemical means seldom presents the whole story, and samples collected near a pipe are generally of little use on account of the effects of back-fill.

The pH value of a soil or of drainage water can be very misleading. Thus in a sandy district the pH may be low due to carbon dioxide and aggressive conditions may exist. Even in a limestone district a calcium bicarbonate solution of pH as high as 8.4 can be aggressive if the conditions are such that carbon dioxide is liberated, although fortunately such districts are usually well drained naturally. It is also possible that over a period of time traces of sulphates from a large bulk of relatively innocuous ground may be concentrated in and around a trench or pipeline due to water movement in the ground.

In general terms clay soils, which constitute the bulk in England, are all suspect so far as corrosive action is concerned, although the degree varies with conditions, particularly moisture content. Made-up ground containing clinker and refuse is, of course, also dangerous.

It is usual in this country to find the most widespread and dangerous form of soil corrosion taking place in neutral, water-logged clay soils in which the access of atmospheric oxygen to the metal is virtually prevented. The first clear explanation of this peculiar state of affairs was made by Kühr and Vlugt (*Water*, 1934, *18*, 147) who discussed the action of anærobic sulphate-reducing bacteria in the presence of sulphates in the soil. The question of microbiological corrosion has received considerable attention during the last decade or so, and it is interesting to note that Beijerinck in 1895 described an anærobic, comma-shaped, motile vibrio as the organism responsible for the bad odour of certain Dutch canals, while Kühr showed that the sulphide on the exterior of corroded pipes buried in wet clay soils was produced by the same organism—namely, desulphovibrio desulphuricans. According to Kühr the bacteria catalyse by cathodic hydrogen, the reduction of the sulphate present in the clay, and thus the corrosion process is rendered continuous, despite the neutral conditions and the absence of oxygen.

Incidentally, work has been carried out by the D.S.I.R. on the search for inhibitors of the growth of sulphate-reducing bacteria. These bacteria appear to be very resistant to the action of ordinary antiseptics, such as chlorine and phenol. Butlin and Vernon have reported that some strains will grow in 1% phenol and in saturated sulphanilamide, while strepto-

(*Continued on p. 425*)

mycin has no effect on them and the action of penicillin is influenced adversely by the presence of ferrous ions. Intensive biochemical work is in progress and an interesting discovery has been reported to the effect that the analogues of sulphates —namely, selenates—prevent sulphates from being microbiologically reduced.

Protection

Corrosion is largely associated with the setting up of small electric currents which discharge at certain points in the pipe into the soil, taking the metal with them. A current of only 1 milliampere passing for five years can remove 1½ oz. of metal from a pipe. It is possible in certain cases to reduce this loss by imposing a potential difference opposite in direction to that produced in the corroding metal.

This method, which maintains the metallic structure in question at a negative potential in respect of the surrounding soil, is called cathodic protection and has been applied to large steel water tanks and to pipelines buried in corrosive soil.

The use of plant for generating the required D.C. low voltage required is frequently inconvenient and the use of anodes of a sacrificial metal has assumed considerable importance during recent years. The anode used must be electropositive to iron, reasonably cheap, and its self-corrosion should be low, so that for all practical purposes the choice is limited to magnesium, zinc, or aluminium. Magnesium is preferable because it produces a higher potential or driving voltage than the other two metals. The economic significance of the electro-chemical currents associated with pipeline corrosion is out of all proportion to their magnitude. It should also be emphasised that cathodic protection is intimately connected with the question of pipe coating because the degree of protection obtained by a single anode is dependent largely on the coating. The object of coating a pipe is, of course, to improve its resistance to corrosion, but since, in practice, no pipe coating is likely to be so completely impervious to moisture as to insulate the pipe perfectly it is well to supplement the coating by cathodic protection, particularly in locations where the soil is known to be corrosive.

Many cases have also been known where cast iron, particularly grey iron, immersed in water or buried in soil under acidic conditions has been attacked. A soft honeycomb graphite in iron structure results which, although retaining its shape, has no appreciable mechanical strength. This phenomenon is known as graphitisation. Sulphate-reducing bacteria can also be responsible for such attack. Attack on buried pipes can also occur due to dissimilar metals, dissimilar soils, or damage to protective films. It is for this last reason that great care must be taken to see that protective wrappings or coatings on pipes are not damaged. Where damage has been suffered, pitting occurs rapidly since it is where the current leaves the metal that corrosion takes place.

The protection of steam and hot water heating systems is also a large subject and includes the question of water softening and treatment. In this connection attention should be drawn to the corrosive effect of dissolved gases evolved from water on heating. Such gases, chiefly air and carbon dioxide, can cause rapid pitting and attack. In certain cases of cooling water in circulatory systems sodium benzoate has been used as an inhibitor. It is suitable for addition to anti-freeze liquids such as ethylene glycol or glycerol.

Reference must also be made to the corrosive action of salts in boilers. Not only will solutions of acids cause corrosion with hydrogen evolution, but also solutions of many salts of strong acids with weak bases. Since the amount of hydrolysis increases with rise of temperature, such salts may be particularly dangerous in water for boilers working at high temperatures.

Magnesium chloride and nitrate are the most usually occurring corrosive salts and they produce magnesium hydroxide and free hydrochloric or nitric acid. Magnesium sulphate is not dangerous alone, but if accompanied by, say, common salt, will react to give magnesium chloride which causes corrosion. Calcium chloride alone is harmless. Small amounts of acid may cause considerable corrosion of iron because hydrolysis may set the acid free again. These dangerous salts are usually removed during the course of water treatment.

Today the use of iron and steel has reached enormous proportions, and even pre-war the production in this country worked out at more than 5 cwt. per year for every man, woman, and child. However, in many fields the supremacy of ferrous metals is being challenged by lighter ones. Nature has provided a larger amount of aluminium than iron to the extent of about 8% of aluminium against 5% of iron, but considerations of energy and, therefore, of economics, have until recently left iron with practically an open field.

The writing is on the wall. A short time ago the first light alloy bridge was opened in the North of England, so that it is necessary to look ahead and see how light corrosion-resisting alloys may fit into future structural schemes.

DISCUSSION

Mr. H. H. Brown (Exeter) said he was impressed by the way in which corrosion was affected by dissimilar metals or by metals under stress, and also by access of oxygen to the metal. It was, of course, true that although aluminium found a low place in the table, the surface chemistry which had been studied recently showed that there was a very fine glass-like coating which formed a protective layer.

One thing which Dr. Marsden might have mentioned was to show that when aluminium was exposed to oxygen and had been made an amalgam with mercury, the mercury attacked the aluminium until a whitish powder of aluminium oxide remained. Another point to which he would like to draw attention was in connection with the outside of a gasholder tank, where a fairly substantial leak had occurred and the paint had been blown out by water pressure into the form of a small bulb. Inside this bulb they found there was a green solution containing iron in the ferrous state, which would gradually oxidise, and the point at issue was that the metal of the surface had been protected by a primer—namely, lead oxide—and the oxidising effect of one was balanced by the reducing effect of the other. The oxygen had actually left the higher metal lead and had gone into solution, absorbed by the ferrous salt, later on to be oxidised; and actually metallic lead was produced in the form of a 'lead tree.'

When considering gasholders, they all thought of the amount of time, energy, and the value of the paint and labour which were necessary to prevent corrosion. He thought the gasholder was very difficult to protect. One thing about unrelieved stresses in metals and the effect of reagents upon them might be illustrated by the use of treatment belts in sulphate of ammonia plants, where sulphate of ammonia was first of all washed with water and then sprayed with ammonia on a monel metal belt. He knew of a case where there was produced on the belt a complete picture of the stresses in the metal.

He had found that with clays in Hampshire and in Devon there was some advantage to be found in examining the pH value but definitely not with sands or limestones.

Dr. Marsden, in regard to Mr. Brown's comment on aluminium suggested that the complicated subject of space lattices was in Mr. Brown's mind, and that might be connected with stresses in metals and also with stress relief. He would remind them that stressed material could behave like dissimilar metals.

He was particularly interested in Mr. Brown's remarks about blisters on the outside of the holder tank. He stated that the bulb contained a greenish solution of ferrous salts, and at the same time the surface of the metal plate had been protected by a lead primer. It was obvious that the iron had not come from the metal. He presumed it came from the water in the tank. It was, to a certain extent, hidden area corrosion, and the conditions of a cell had been set up so that the lead had become sacrificial. It was protecting the surface, as it was intended to do, and being confined it had grown out as a 'tree.' He thought it was an example which was rather rare, but it was very interesting.

So far as the monel metal was concerned, he had seen an example similar to the one described by Mr. Brown, and the

attack was such that it would be possible to see the stress lines.

Incidentally, in connection with under-water corrosion, the sulphate-reducing bacteria were the same as those which produced hydrogen sulphide in the water of gasholders. These bacteria worked at a certain level below the surface and produced there the highest concentration of hydrogen sulphide.

Mr. Brown remarked that, in relation to the hydrogen sulphide being liberated by gasholder water, some years ago they had a holder which they cured by putting the holder out of action and circulating the water which contained this bacteria over the top of the holder in the sunshine, and the sunshine killed them. They had no further trouble with that holder.

Mr. A. P. Jennings (Plymouth) said there were various opinions about the correct treatment of a new holder or a re-sheeted holder. Should a new holder be left to weather before painting, or be given some protection immediately? Mention had been made of flame-scaling, and he wondered what was the effect on the tape in the joints where that method of descaling was used.

It was mentioned in the paper that iron was frequently galvanised or covered with zinc, and corrosion of the iron was thus prevented and the zinc coating was sacrificed until no more remained. Did this mean that if an iron sheet was galvanised to a greater thickness than was usual it did not make any difference eventually because that coating would be sacrificed and then the normal corrosion would take place? He had always understood that the galvanising was, in fact, a permanent protection against corrosion, but the fact that the sheets did corrode eventually was either because they had been badly plated or not thickly enough, or due to cracks developing in the surface; but it would appear that it actually dissipated over a period of time.

He inferred from the paper that one would expect corrosion to be more active on the rivets of the holder which were under greater stress than the sheets which had been riveted.

Dr. Marsden said that, regarding the question of the new holder, if time was available the plates were allowed to weather in the contractor's yard until all mill-scale was removed. That was the ideal state of affairs, after which, of course, they should be brushed and given a coat of boiled oil. That again was not always done. In any case, if all the mill-scale could not be removed, then all unbonded scale should be removed and the plates should be given a coating of good red lead. Seeing that a certain amount of the red lead was bound to be removed and damaged during transport and erection, he would treat all these places again with red lead, bearing in mind that red lead was essentially a primer and not a paint.

He would not attempt to apply flame de-scaling to the riveted bell of a holder. There might be a risk of damaging the taping. The idea of flame de-scaling was to use it on those portions of structures which could not be easily de-scaled by chipping and brushing. A relatively plain surface could be reasonably well cleaned by wire-brushing.

The underlying theory of galvanising was that the zinc was sacrificial to the iron. It was the zinc which disappeared when corrosion was taking place. Galvanised sheet was specified in respect of the thickness of the coating, but assuming that the coating was perfect then there would be no attack on the iron until the zinc had gone, and then the usual corrosion would affect the iron. So far as rivets were concerned, one would expect the stressed rivets to corrode more quickly than the steel plates, but in the case of rivets containing copper, protection was conferred upon them.

Mr. J. Denton (Torquay) endorsed Dr. Marsden's remarks on flame treatment, which they had applied to a coke structure, upon which they obtained good results, and in a large measure cleanliness in the corners was obtained by this process. What was Dr. Marsden's opinion of copper-bearing steel rivets, because they had two dissimilar metals there, and they had had many examples on iron holders? His opinion was that they were poor.

If Dr. Marsden could give them the points to look for on the works it would be helpful. He was thinking particularly of stress relief. On a very small holder station they had been doing what appeared to be a rather ridiculous thing—dusting or buffing the holder—with the idea of keeping the paintwork polished. But this might keep the paintwork so clean and free from the effects of electrolytic corrosion as to be of some value.

Dr. Marsden said that the two chief places where graphitisation was likely to occur were: (1) in the inside of water pipes, and (2) in buried cast iron pipes. The nature of the soil was examined in the vicinity of the pipe, and if conditions were acidic then the immediate surround was removed and should be back-filled with limestone dust to make it alkaline, or cathodic protection might be used. If there was internal attack, then the water must be examined.

This brought them to the case of dissolved gases. There were not only relatively simple tests for these, but there were limits laid down, particularly, of course, in connection with high duty boilers such as the high pressure water tube type. The amount of gas which could be tolerated was very small, but in ordinary low pressure steam or water systems there were two things which they could do—either to de-gas or remove chemically. But it must be remembered that for ordinary low pressure hot water systems, if the softening was carried out hot, then for all practical purposes the majority of the gases were removed. At the same time there should be adequate vents on the system. But if they were to ask him to state precisely where they should look for these things, it was rather difficult, because every case presented different circumstances.

Mr. James Carr, M.B.E., said that in a paper given three years ago there was reference to three holders the bells of which were flame-scaled. Two were successful, and the third had to be practically re-sheeted. The whole of the tape was burnt away. In regard to mill-scaling, the only holder he could think of being left for a long time was one in Sheffield which the late Duke of Kent inaugurated, and it was left at the early stages of the war. It proved a very costly business to put that holder right after exposure to the atmosphere.

Mr. Carr said it would have been helpful if Dr. Marsden had put in the paper a review of the experimental work which he was now carrying out on protective painting chiefly for structural work. He wondered whether the author could tell them at the moment just how the tests were going, and what they could look forward to in first-class guidance for the right type of paint and protective coatings which they should purchase.

He hoped all would take the paper very much to heart and call for advice when there was doubt about the sub-soil on the line of the mains. The Chairman (Mr. C. H. Chester) could tell them that he had some hard experience with very bad sub-soil in various parts of the Swindon sub-division. Some of the soils they had to deal with were very costly.

Dr. Marsden said that all clay soils were suspect. If it was intended to lay a main in clay soil then they must have the pipe adequately coated—and the great point was to see that the coating was not damaged during the laying—and then apply cathodic protection in the form of sacrificial anodes.

The reason the paint testing project was started was that they were not too satisfied with the suggestion that certain accelerated tests would tell them all they wanted to know, and fortunately at that time they were committed for a certain length of time which gave them breathing space. In that time they instituted experiments in the field. They had been going for two years now, and many paint manufacturers had sent them their 'systems'—the system being primer, undercoating, and finishing coat. Almost without exception the paint suppliers said that they were quite satisfied with what was going on, and looked upon the work as very useful. A paint film like glass was an outstanding example of compromise. The best paint was the one which combined the various properties in the most useful proportions. They went to a gasholder and did the job of cleaning properly, and then took a row of plates on the second lift of the bell facing the prevailing winds—south west—so that it would get a fair proportion of immersion and exposure to sun, wind, and rain. The test holder was quite close to a water gas plant, where it got liberal doses of sulphur dioxide and a reasonable amount of grit. They arranged that each of these plates should have a 'system' put on it, and also that for each paint a row of rivets should be included.

In another month or two he would be able to say much more than at present. For about the first year one could examine the various systems and there was nothing much to choose between them. All these paints had a number, and when they were being examined the various people on the staff who looked at them did not know the name of the

(*Concluded on p.* 429)

supplier. They were quite impartial and classified the paints each month. Now some were beginning to fall by the wayside very quickly. Of the 20 samples included, six had been eliminated. At the present time it would seem that there were, perhaps, six or seven about which he was not in a position to say anything definite, but in a few months' time it should be possible to narrow them down to two or three.

Mr. C. H. Chester, C.B.E. (Chairman of the South Western Gas Board), proposed the vote of thanks to Dr. Marsden. He remarked that about 20 years ago they encountered some very difficult soil in Swindon. He saw quite a few geologists about it. The services in this soil had not lasted five years. They were ordinary wrought iron or steel. From then onwards they practised cathodic treatment of the mains and the services in that area, but they had in addition to put extra protection on the services. Often they found that with protection the service layers themselves had neglected to apply protection at the joints, and the whole of the good work was lost. He would remind the meeting that there was as much capital in the mains under the ground as there was in the plant above.

Mr. C. R. Ingham (Bristol), seconding the vote, mentioned that they were contemplating laying mains to a site in Bristol where they knew they would have trouble from bacteria. They had met the pipe manufacturers, the waterworks representatives, and Dr. Marsden, and another expert from the Iron and Steel Research Association. They came to the conclusion that the sacrificial anode method was the one they should adopt. They also considered, in a portion of the housing sites, the use of asbestos cement pipes. He had been told that these might be all right on low pressure, but not on high pressure. He was not quite sure why. He supposed the danger was diffusion of gas through the wall of the pipe. If that was so, one would think it was not beyond them to devise some means of preventing it.

Dr. Marsden said that this question of the asbestos cement pipes was under consideration, and, like Mr. Ingham, he was not certain why they did not stand up to high pressure. If the trouble was due to diffusion of gas through the pipes, then internal treatment with one of the new plastics might provide the answer.

BACKGROUND OF APPLIANCE DESIGN

(*Concluded from p. 412*)

the case of the gas fire, increases in thermal efficiency will be attained by increasing the output of convected heat, while for domestic water heating this will have to be sought in improvements in the method of installation and in the general layout of water heating systems, rather than in the heaters themselves. While a high thermal efficiency is essential, it must not be made a fetish. It is better to sacrifice some units of efficiency if by so doing other and more important advantages are gained.

In Great Britain there is much coal suitable for gas-making and the plans of the National Gas Board should provide sufficient coal for the gasworks for the next century. Nevertheless, endeavour is being made in Great Britain, as in Australia, to introduec gas-making processes which will render available a much wider range of fuels. The continued success of the industry will depend primarily upon the cost of gas in relation to that of other fuels. As the prices of existing fuels increase, other sources of heat, so far too costly to exploit, may come within the economic range. In general, however, there is no reason to anticipate that in the near future we shall meet with unexpected competition.

Further advances must be based upon the closest research into the fundamental processes underlying the utilisation of gas as well as on a thorough investigation of the conditions of use and of the methods and materials available for the construction of apparatus. Our task is not merely to give the public what it wants. We must have the knowledge, and the ability to use the knowledge to practical effect, so as to provide new conceptions and methods which make for the health, comfort, and general well-being of the individual. We must lead and not follow public demand.

RESEARCH BULLETINS

The Institute of Gas Technology, Chicago, has resumed publication of its Research Bulletin Series, suspended since 1948. The fruits of the intervening three years of basic and applied research are being issued in a series of 16 bulletins.

Two of them, 'Sulphur Poisoning of Nickel Catalysts,' by C. H. Riesz, H. A. Dirksen, and W. J. Kirkpatrick, and 'Expansion Behaviour of Coal During Carbonisation,' by O. P. Brysch and W. E. Ball, have already been published. A third, 'Pilot Plant Catalytic Gasification of Hydrocarbons,' by C. H. Riesz, P. C. Lurie, C. L. Tsaros, and E. S. Pettyjohn, is in the hands of the printers. Others are to appear as rapidly as careful editing and printing permit.

In explaining the interruption of the series from 1948 to 1951, Mr. E. S. Pettyjohn, Director of the Institute, said that at the time of the suspension the consensus of opinion was that reports on research projects prosecuted for the American Gas Association should be made to the conference concerned —production to the Production and Chemical Conference, natural gas to the Natural Gas Department—and that interim reports should be presented to the industry through papers published in the AGA Monthly. However, this division and piece-meal publishing proved ineffective, in that it involved correspondence with the committees or the Institute, and literature searches and compilation of data, by each person who sought to secure the results of a study in their entirety. It became increasingly apparent that the Research Bulletin Series should be re-established to make available the complete data obtained in the research programme.

The editorial arrangement of the bulletins conforms to specifications of the American Gas Association.

LABOUR RESOURCES

TO ensure that all those who want to change their employment and all those who are looking for work are guided into jobs which are not only suitable for them but are also of importance to the nation, the Minister of Labour and National Service, Sir Walter Monckton, has made the Notification of Vacancies Order, 1952, which comes into operation on February 25.

There will be no 'direction' to work as there was under the old Control of Engagement Order. Workers covered by the Order are under no obligation to take jobs they do not want. They will be told of the important vacancies and asked to take them willingly. If they do not want these jobs they will be offered vacancies in the kind of work they desire.

With certain exceptions the Order restricts and controls the way in which employers may (a) seek to engage any worker and (b) engage any worker who is between 18 and 65 years of age (if a man) or between 18 and 60 years of age (if a women). Where the Order applies, an employer must not 'seek to engage' except by (a) notifying a vacancy to an employment exchange or a scheduled employment agency or (b) by an advertisement that requires a worker anwering it to go to an employment exchange. The Order covers all kinds of work and all workers with certain exceptions, which include coalmining and employment in a managerial, professional, administrative, or executive capacity. There is no suggestion that there should be any sort of 'ring fence' round coalmining (or any other industry), which prevents the worker leaving the industry.

'Managerial capacity' does not mean every job which carries the title 'manager.' It means employment as a salaried employee in charge of a department, a works, or an office. This includes superintendents, general foremen, and head foremen in charge of other foremen, but not foremen, chargehands, piece workers, or anyone who is paid by the hour. Employment in a 'professional, administrative, or executive capacity' includes the employment of accountants, architects, solicitors, doctors, dentists, nurses, secretaries of clubs or companies or institutions, surveyors, clerks of works, and a number of other non-manual occupations.

Workers outside the Order include anybody under 18; any man of 65 and over and any woman of 60 and over; and any woman having a child of her own under 15 and living with her.

TRADE NEWS

Communal Laundry Equipment

IT is curious that with the considerable variety of labour-saving appliances on the market, there has existed a lack of equipment suitable for the communal laundry. Communal laundries are no longer new, and yet architects and local authorities have had no alternative but to install batteries of domestic washing machines which, although no doubt excellent in themselves, were never designed for such concentrated use. There is now a solution to this problem and one which, we believe, will exert a considerable appeal to those concerned with this type of installation.

Nearly a year ago we were able to reveal that Electrolux, Ltd., were planning the introduction in this country of Swedish-built laundry equipment. On January 31 we inspected one of the first installations of this equipment, at the Wandsworth Borough Council's Notre Dame Estate. In common with many building schemes of this type, the Notre Dame Estate provides facilities for tenants to do their family wash in specially designed quarters, thus obviating the unpleasant conditions arising from the flat dwellers' attempt to undertake this task in the home, with the consequent wet, steamy conditions and lack of drying arrangements.

Not a Domestic Appliance

This equipment must not be confused with the domestic washing machine. It is, speaking broadly, a scaled down commercial laundry, which has been produced after considerable examination of the problem of family washing on council estates, and consists of two principal elements, a washing machine and a hydro-extractor.

It has been established that the average family wash comprises 18 lb. dry weight of clothing. To meet the requirements of good laundering and of hygiene, a communal washing machine must be able to handle this weight of clothing, wash at a water temperature of 180°F., and should be capable of boiling when necessary. The machine must be of simple construction, free from complicated mechanism and be able to stand up to vigorous treatment.

In all these respects the Electrolux washing machine is an advancement on anything previously used in council installations. It is of steel construction and can handle 22 lb. dry weight of clothing. The clothes are washed in a revolving drum at the slow rate of 32 revolutions a minute, working on a cycle of eight forward revolutions then eight in reverse. This ensures thorough but gentle cleansing.

The washing process is simple. The clothes are soaked for a few minutes in cold water which is drained and the washer refilled. The water is then heated to the washing temperature of 180°F. The complete wash, including two or three rinses, takes about 30 minutes. The inner cage is of nickel-chrome steel, perforated and fitted with three smooth lifters, and the inner cage door is designed as a sliding shutter; it is of ample dimensions and is nearly the length of the inner cage. The door is secured by two spring loaded clips of special design which preclude the possibility of clothes working their way out of the cage and being damaged. The design of the door has the additional advantage of retaining full rigidity of the inner cage. The outer drum has a capacity of 50 gal., and the casing and bottom frame are of chrome steel with the minimum of joints to facilitate cleaning.

A view of the Electrolux washing machine designed for use in communal laundries. The photograph clearly illustrates the revolving drum in which the clothes are agitated.

Special features are that only a cold water supply is required and that the supply pipe is not coupled to the machine. The inlet aperture is fitted with a flap which closes automatically when the flow of water ceases. The water jet is fully visible, making it easy to detect leaks or when the stop cock has been left partially open. Water outlet is through a 1¼ in. pipe fitted with an all metal sluice valve by which flushing out the machine can be done quickly. A second tap is provided just above the sluice valve for collecting used suds. A waterproof switch is fitted on the casing of the driving gear and is easily accessible from the front of the machine. The driving gear, arranged at the right hand end of the machine, consists of an electric motor with an entirely enclosed worm gear of ample dimensions.

The machine can be supplied for heating by gas (type TMG) or electricity (type TME). On gas-heated models a double ring burner, with pilot, is fitted in an insulated combustion chamber immediately below the outer drum. The flame can be seen through a small inspection port. Gas consumption is 0.5 therm per hour; consumption per wash, 0.25 therm.

Electrolux, Ltd., are also marketing a hydro-extractor for use with the washing machine, and also a convenient type of laundry truck. The hydro-extractor is built on the same sturdy lines as the washing machine. It is designed to take a load of 14 lb. dry weight of clothing in one operation, and in five minutes it removes the greater bulk of the water content from the clothes. One machine can therefore deal with a full family wash in about 12 minutes, and can deal with the washing of two washing machines. This method of hydro-extraction is an advancement on wringing or spin drying, the method generally employed in domestic washing machines, since the hydro-extractor operates at a speed of 1,400 revolutions a minute compared with something like 300 revolutions of a domestic washing machine spin dryer. To the housewife it means all lighter garments are ready for ironing, only heavy items like sheets needing further drying.

At the Notre Dame Estate, tenants have received full instructions on the working of the appliances and are able to carry out their complete family wash, even including thorough drying (in Barralets drying cupboards) in 75 minutes.

Whessoe

The recent publication issued by Whessoe Ltd. under the heading of Petroleum Equipment, summarises the work Whessoe undertakes for oil refineries and storage plants. Among items of interest to the gas industry are heat exchangers for all duties. Manifestly the heavy welded plate work so largely employed in the oil industry for fractionating columns and for the storage of volatile products such as butane, is not dissimilar to the equipment required on gasworks and coke ovens. In addition this illustrated leaflet gives capacity tables of a standard range of steel storage tanks made by Whessoe, equally applicable for the storage of gas oil, tar, water and ammoniacal liquor, etc.

Applications for copies of this publication should be made to the company's address at Darlington or to *25, Victoria Street, S.W.1.*

Trade Publications

We acknowledge with thanks the following:—

Air Control Installations, Ltd. Publication G.512 'What We Make' and Publication R.514 entitled 'Dust Control by Rotoclone.'

De La Rue & Co., Ltd. De La Rue Journal No. 15. Containing interesting articles of their activities all over the world.

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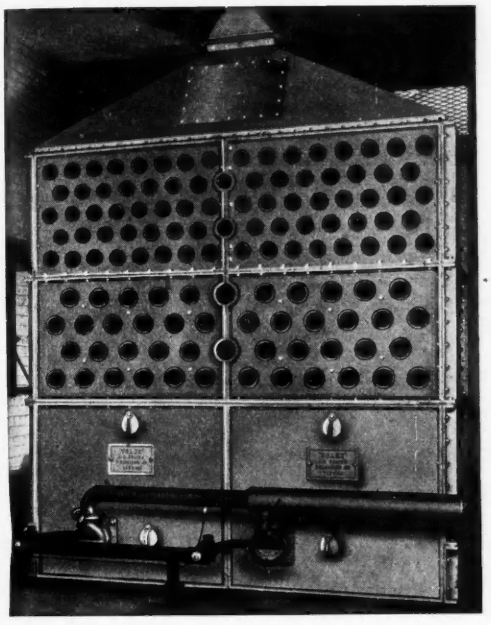

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CONTENTS

Page

EDITORIAL COMMENT

The Waste Heat Turbine 461
Highly Skilled Technique 462
Tariff Policies 462
Consultative Councils' Protests 463
Tariffs for Bread Baking 463
'Gasair' Plant 463

LETTER TO THE EDITOR

The 'R' Ratio. R. J. S. Thompson (W. C. Holmes & Co. Ltd.) 463

NEWS OF CURRENT EVENTS

Personal 464
Obituary 464
Diary 464
British Wood Preserving Association 465
British Gas Staff Association 465
Boring for Natural Gas 465
Gas at National Ice Cream Exhibition 465
Compensation and Income Tax 468
Ideal Home Exhibition 468
Institution of Gas Engineers Examinations 468
Gas for Hospital Board Headquarters 468
Gas Service Conference: Revised Programme ... 469
Bravery Rewarded 469
Glasgow's Record Output 472
Dust Gasification 472
Publications Received 472
Domestic Coal Prospects 474
Steel Rationing 474

IN PARLIAMENT

Capital Investment: Power of Entry: Departmental Responsibilities 469

CONSULTATIVE COUNCILS

Southern: Protest to the Minister of Fuel and Power 466
Northern: Coal Price Discrimination Alleged 467

AMERICAN SPOTLIGHT

Topical Items from the Technical Press of Canada and the United States 470

FEATURE ARTICLES

Health of Workers in the Gas Industry. By Dr. Frank H. Tyrer, M.A., M.R.C.S., L.R.C.P., D.I.H., Medical Officer to the West Midlands Gas Board 471
Gas Industry in France: A Selection from the French Technical Press. By Ashton 473

TECHNICAL RECORD

Electricity in Gasworks. By W. F. Blakeley, Assoc.M.Inst.Gas E., Chief Engineer's Department, North Eastern Gas Board 478
Application of Gas Turbines in the Gas Industry: Discussion on Paper by A. W. Pope 479
Technical and Sales Requirements for Appliances. By G. H. Fuidge, B.Sc., Chief Physicist, South Eastern Gas Board 483

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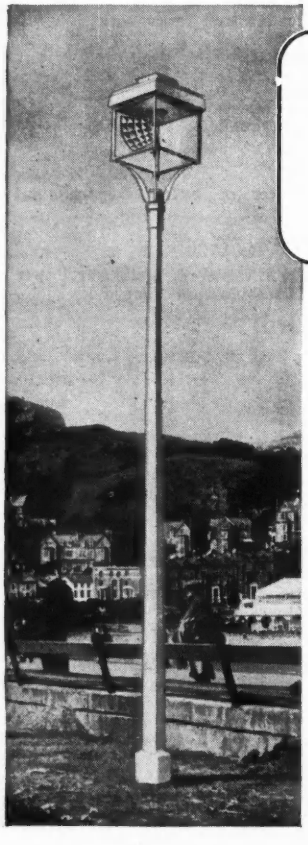

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